MINING CONGRESS JOURNAL

AUGUST 1959





1959 MINING CONVENTION

Denver, Colorado

September 14-17

BEFORE You Buy a THICKENER . . . BE SURE!

USE DENVER Testing Service

TO DETERMINE CORRECT THICKENER SIZE FOR YOUR NEEDS.

No cost to you for this test service!



ELIMINATE RISK!

Let DENVER's 30 years of laboratory and world-wide field experience help you to eliminate risk—determine the right thickener for your needs—verify your own tests or recommendations of others. DENVER's experience covers a wide variety of materials plus the opportunity to relate test results to actual field operations. Laboratory tests, conducted at no cost to you, supply reliable data on

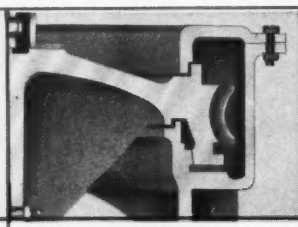
(A) Settling Rates **(D) Thickener Unit Area**
(B) Final Density **(E) Overflow Clarity**
(C) Effect of Flocculating Agents

TESTS AT NO CHARGE — *These tests can assist you by eliminating risk of specifying a thickener that's too small to do the job or too large and costly for your needs.* Ship 5 gallon slurry sample prepaid to Denver Testing Division, 1755 Blake St., Denver, Colo.

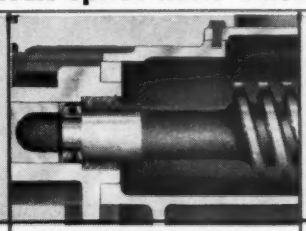
Compare these distinctive features of DENVER Spiral Rake Thickeners:



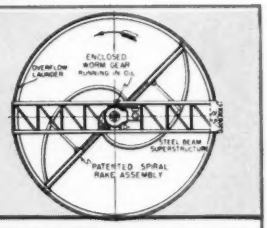
NEW ENCLOSED HOUSING protecting gear and drive mechanism is simple and rugged—available in sizes through 72" for light, medium, heavy and extra heavy duty. Tanks, steel or wood, in sizes to 150'. Write for Bulletin T5-B6.



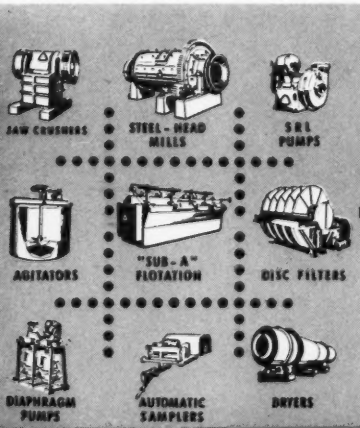
HIGH STRENGTH GEAR rides on replaceable no friction—no wear formica pads placed at periphery of the gear. Maximum stability, low bearing pressure and oil bath assure long life.



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VOL. 45 AUGUST 1959 NO. 8

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ON OUR COVER

Pikes Peak through the Gateway of the Garden of the Gods. Those attending the 1959 AMC Mining Convention will have the opportunity to see many of Colorado's famous scenic spots. For the full story on the big event of the year for metal miners and industrial mineral producers, see pages 44 to 57.



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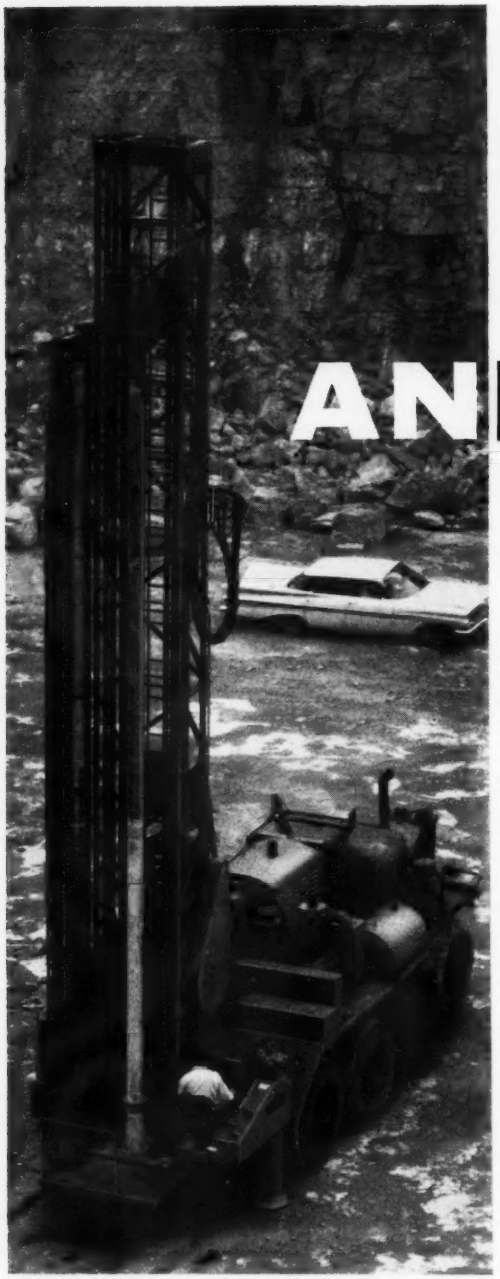
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ANNOUNCES

TO THE MINING INDUSTRY ITS NEWEST MANUFACTURING AND SALES FACILITY:

REICHdrill
DIVISION: CHICAGO PNEUMATIC TOOL CO., NEW YORK

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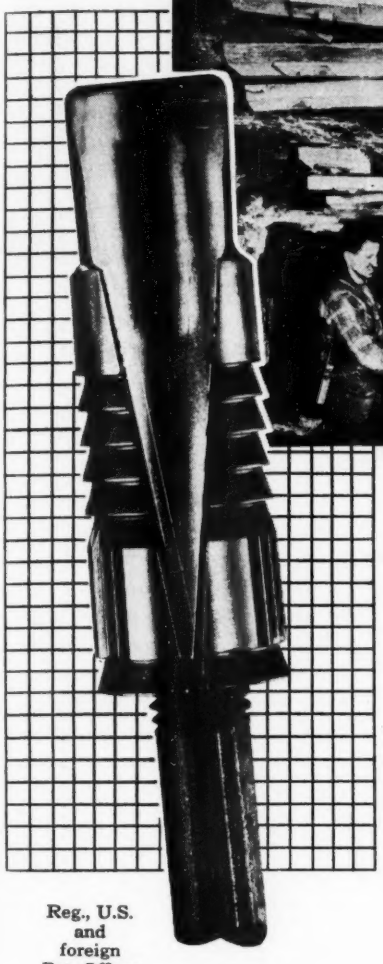
The acquisition of its new REICHdrill Division affords Chicago Pneumatic an unexcelled diversification in the field of drilling equipment.

REICHdrills, both truck and crawler mounted, are hydraulically-powered rotary blasthole drills. For detailed information concerning REICHdrills, or other CP Drilling Equipment, write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N.Y.*

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In Western States

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Most mines can Roof Bolt

Effectively and Profitably....

WHILE each mine may be different in physical characteristics, in method of operation or types of equipment used—all mines have one problem in common—the problem of keeping the roof in place.

Hundreds of mines, with all different kinds of roofs, have proved that roof bolting is the best form of roof control. They have also found that bolting leads to increased safety, better ventilation and greater production efficiency. Roof bolting offers so many profitable production advantages it justifies any mine, now using conventional timbering methods, making comparative roof support tests. Bolting tests can be made at very little cost.

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Shown above is the outstanding PATTIN style D-1 expansion shell. Samples of the "D-1" or "D-2" shells will be furnished upon request.

PATTIN MANUFACTURING COMPANY

"69th Year" MARIETTA, OHIO



EXIDE-IRONCLAD BATTERIES

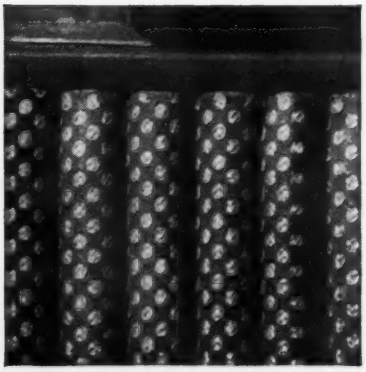
—best buy for the long haul

More ton-miles per dollar—that's the reason most cost-conscious mine operators prefer Exide-Ironclad Batteries for mine locomotives.

Experience has proved over the years that no other battery make matches Exide-Ironclad for average life in service and tonnage hauled. Rating for rating and dollar for dollar, Exide-Ironclad gives you more real value . . . more return on your investment.

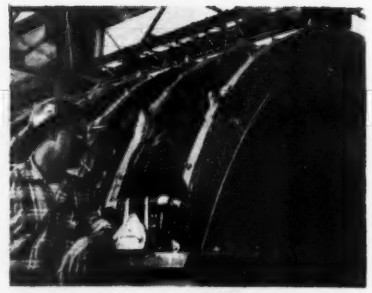
Today's Exide-Ironclad features improved tubular construction, making it even better than the models that chalked up the industry's records. So you can expect even longer life potential and superior performance.

Total work output, not mere price, is the key to battery economy. When you buy batteries, specify Exide-Ironclad and get the most production capacity your dollar can buy. For details, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.



50 years ago, Exide patented the now-famous Exide-Ironclad tubular positive plate battery. For power and economy, nothing has ever matched it. Yet Exide engineers have constantly improved it. Today's battery packs more power, gives longer life and greater economy than ever before.

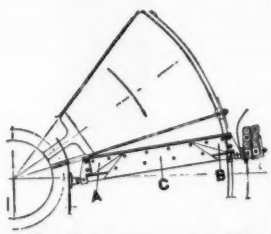
Exide®



Contour Scrapers

Lower Cake Moisture

After installation of the Peterson Contour Scraper*, the customer reported a 4% lower cake moisture on the disc with the new scraper. Note the smooth, uniform cake on the first disc. He says with the Contour Scraper, there is no re-filtered cake to make lumps which have high moisture. With Contour Scrapers on all discs, this customer expects to use less fuel to heat dry the cake.

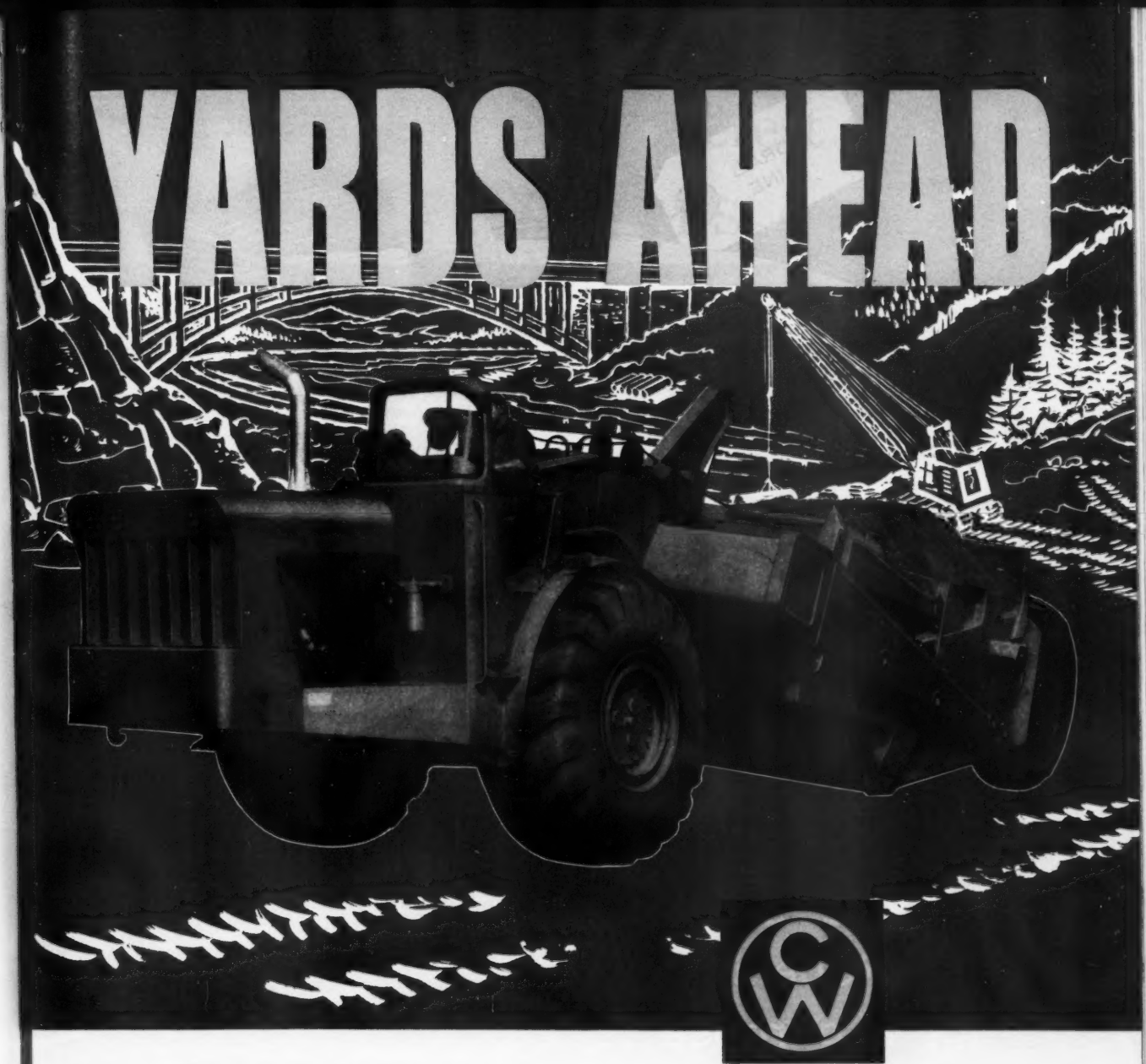


How the Contour Scraper Works:
The Contour Scraper is a three-section scraper. as shown above. Rubber blade is held by Plates A, B, C, which hinge independently of each other. As the bag inflates, the center section, plate C, contours out while sections A and B remain in place. Blade contours to the bellow. The action remains free, no freeze from sludge becauses all parts are sealed and lubricated.

Contour Scrapers can be made to fit any type disc filter.
Write for folder CS-102-A.
*pat pend.

Look for filter parts with the Viking Mark

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CURTISS-WRIGHT MODEL

226

CW-226 SELF-PROPELLED SCRAPER

Capacities: 26 cu. yds. struck, 36 cu. yds. heaped, 78,000 pound rated load

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Throughout the cycle — from the easy loading, through the high speed travel, to the fast dump, you're YARDS AHEAD with Curtiss-Wright scrapers. Designed and built to meet the skyrocketing production demands of today's construction industry, the CW-226 gives users a daily output unmatched by any competitive machine. See how the CW-226 can give your job a production boost — Let your C-W distributor give you complete details on the "Yards Ahead" features of the Curtiss-Wright line.

SOUTH BEND DIV. CURTISS-WRIGHT CORPORATION, SOUTH BEND, INDIANA

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MACWHYTE Wire Rope

Wire Rope made for a purpose—to serve you better

Manufacturers of special wire ropes for strip shovels, loading shovels, draglines, shaft hoists, haulage, underground scrapers, loaders, mining machines, conveyors, car pullers, and blast hole drills.

A recent communication* of exceptional interest to SHUTTLE CAR BUYERS and USERS

OLD BEN COAL CORPORATION

360 WEST JACKSON BOULEVARD, CHICAGO 6, ILLINOIS. DEARBORN 2-2360

June 11, 1959

Mr. T. T. Pattison
Sales Manager, Equipment Division
National Mine Service Company
Koppers Building
Pittsburgh 19, Pennsylvania

Dear Mr. Pattison:

As you probably realize, we have now had over two years' experience with the operation of two of your TorKars at our Mine No. 9. Our initial experience with these cars was so encouraging that about a year and a half ago we ordered four more. These six machines have been in continuous operation since installation serving high capacity boring type continuous miners and have conveyed in excess of one million tons with a very minimum of down time. Maintenance costs have been highly satisfactory.

We hope that the 12 48AC TorKars recently ordered from you for our new Mine No. 21 will prove to be as good as, if not better than, the D. C. type at Mine No. 9.

It is not often that we write a letter of commendation to a manufacturer on the performance of his equipment but TorKar performance justifies a letter of this type.

Yours very truly

William C. Campbell

Assistant to President

WCC:MM

The trend is to TorKar



Write for informative new TorKar Bulletin and specification sheets on 26" to 60" models

This letter from one of the larger and most respected coal companies in America puts on paper the reaction of many leading producers to the single-motor TORKAR. It is gratifying indeed for us to experience such acceptance for a major product in the few years since its introduction. More than ever, we urge anyone interested in shuttle car performance to see the TorKar demonstrated. Its action speaks louder than words!

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IN MINNESOTA IRON MINES

6 cu. yd. P&H Model 1600 Electric digging frozen hardpan.

FROM THE MEXICAN TO CANADIAN



IN ARIZONA COPPER MINES

8 cu. yd. P&H Model 1800 Electric digging conglomerate cemented gravel.



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One P&H
sells another because

P&H "PROFIT·TONS" reduce loading costs... even in hardest digging

Up to 30% higher bail pull—faster swing—exceptional physical strength of P&H welded construction—greater job availability all add up to as much as 10% more production, lower loading cost per ton and *more net profit* for owners of P&H Electric Mining Excavators on their hardest digging assignments.

P&H "Profit-Tons" are the end product of these *exclusive* P&H design principles:

MAGNETORQUE• . . . the most productive digging motion drive known for electric excavators. This *patented* P&H drive electro-magnetically transmits full digging power from an A. C. hoist motor direct to the dipper without motor generator set conversion to D.C. current. It gives higher bail pull, better dipper fill factor and automatic impact protection to the digging machinery.

ELECTRONIC CONTROL . . . the most responsive control for electric excavators. This *patented* P&H control accomplishes the quickest work motion reaction time and gives the greatest cycle productivity known.

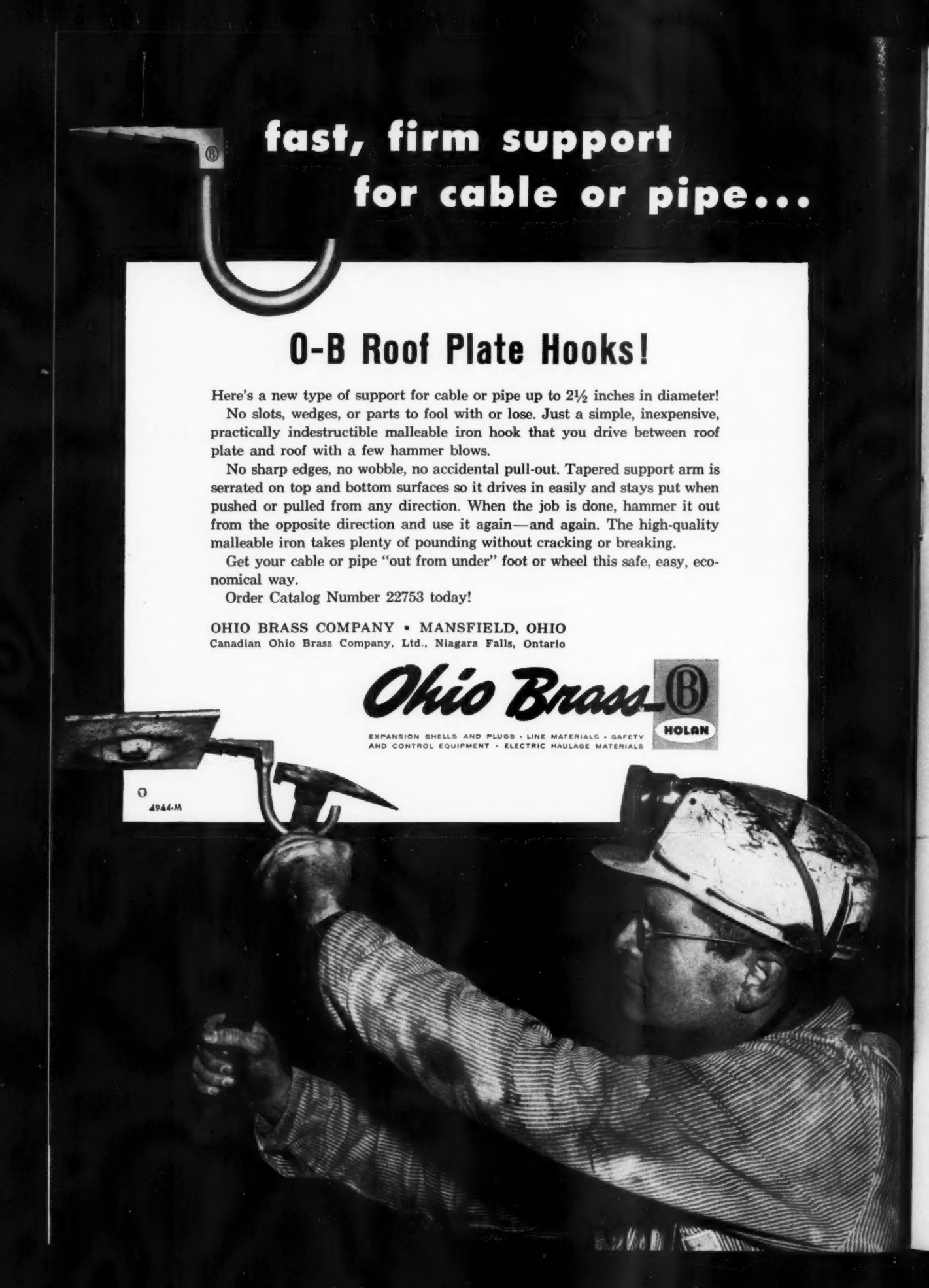
In addition, with P&H—and only with P&H—do you get the service assurance of single source responsibility. P&H manufactures their own electrical as well as mechanical components—*designed specifically for electric excavator service.* Write Dept. 556, Harnischfeger Corporation Milwaukee 46, Wisconsin.

P&H LINE:

Electric Excavators:	3½ through 10 yds.
Diesel Excavators:	½ through 3½ yds.
Truck Cranes:	10 through 80 tons

P&H **MINING EXCAVATORS**

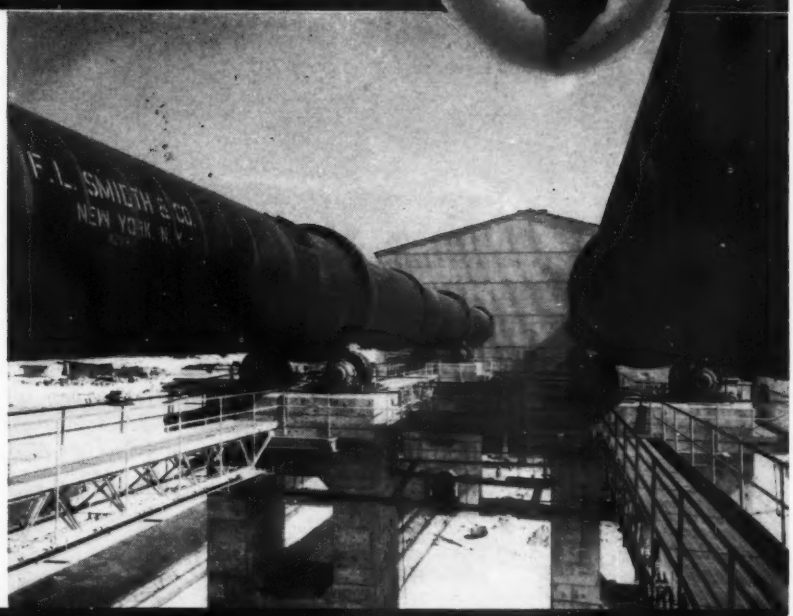
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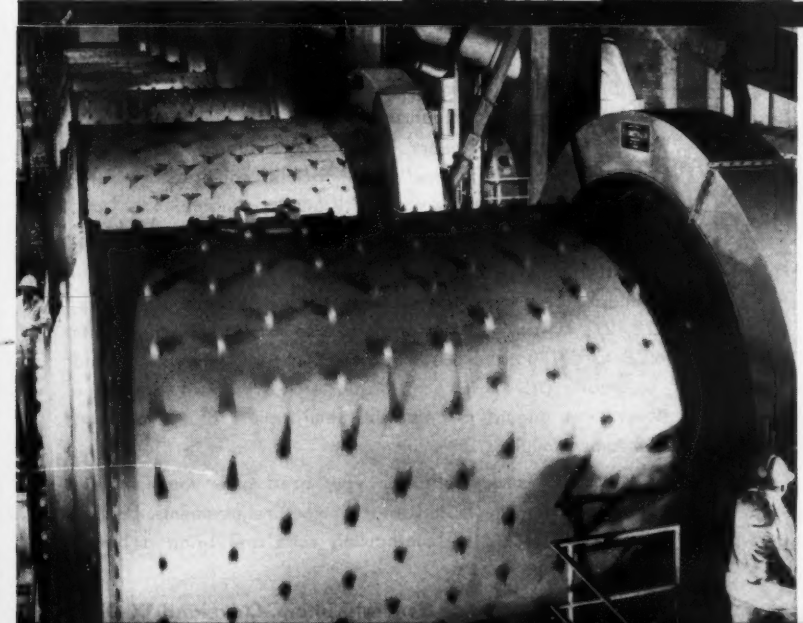

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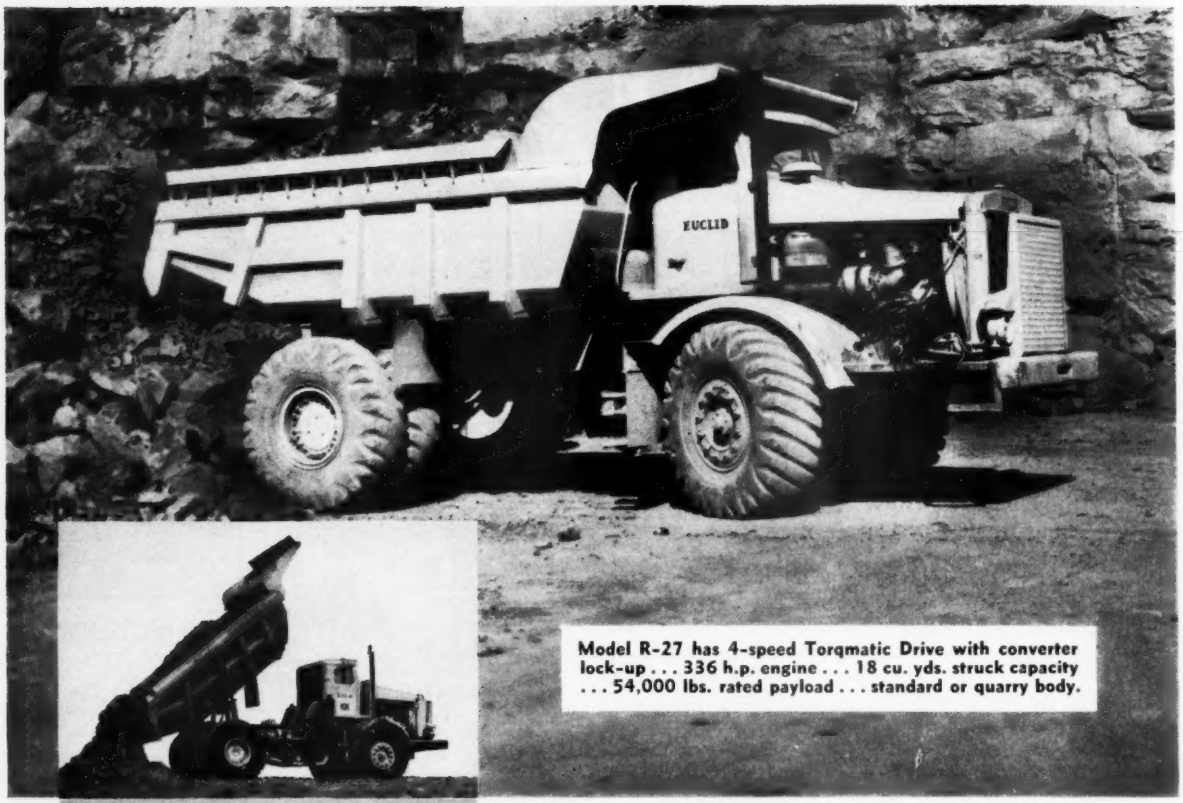
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Model R-27 has 4-speed Torqmatic Drive with converter lock-up . . . 336 h.p. engine . . . 18 cu. yds. struck capacity . . . 54,000 lbs. rated payload . . . standard or quarry body.

Rock Bottom Hauling Costs with Euclid Rear-Dumps

THE simple but rugged design of Rear-Dump "Eucs" has provided cost cutting performance in mines and quarries for over 25 years. This unmatched experience in building dependable off-highway haulers, combined with continuous product improvement and excellent dealer facilities for parts and service, results in high job availability and low maintenance cost.

Euclid's line of rear-dump haulers for mine, quarry and construction work is the most complete in the industry. With standard or quarry bodies, there are models with 10, 15, 18, 22, 27, 40 and 55 ton payload capacities . . . engines from 128 to 670 total h.p. . . . 5 and 10-speed transmissions and Torqmatic Drives. For close quarter work there are three over-hung engine models with semi-trailers of 12, 22 and 35 ton capacities.

Have the Euclid dealer in your area give you complete information on the models that fit your requirements. He can show you how "Eucs" cut hauling costs and bring a better return on your investment.

EUCLID Division of General Motors, Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

another continuous mining advance . . . newest

Bowdil MULTI-BAR RIPPER HEAD

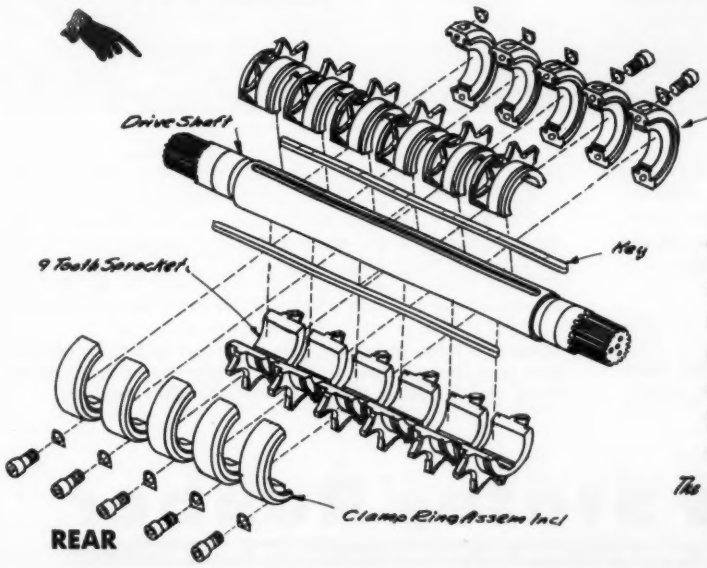


IMPROVED

special hard-surfaced Wearing Shoes used in heads of the Cutterbars eliminate maintenance on roller and bearings as formerly used.

REAR OF THE RIPPER HEAD FRAME

Sprockets are clamped to an oversize Shaft, locking Shaft and Sprockets into an integral unit equivalent in strength to a 9" diameter Shaft . . . completely eliminating deflection, the chief cause of bearing failure.



ADJUSTABILITY

Each Cutterbar is independently and easily adjusted thru side ports, making it possible to retain equal tension on all chains at all times.

INTERCHANGEABILITY

All chains are similar in kerf and lacing arrangement for interchangeability as desired. All sprockets are also interchangeable. Chains may be run with or without renewable liners in the Cutterbars to suit your conditions.

RIPPER HEAD ASSEMBLY

includes a special improved design Head Drive Shaft and Sprocket Assembly which makes it possible to renew a sprocket IN MINUTES without removing the Shaft . . . two-piece sprockets, held on the Double Keyed Shaft by special design Resilient Clamping Collars, maintain extreme tension to the Shaft.

► DEPENDABILITY

This design MULTI-BAR RIPPER HEAD is made from high grade alloy heat-treated steels. It has been, like all Bowdil products, thoroughly tested under severest conditions over a long period of time before announcement. This is in keeping with the standards of

The BOWDIL COMPANY
CANTON 1, OHIO

► *For illustrative information of this unit, write or call the factory:* **GLendale 6-7176**

CONVEYOR BELTS

"After 20 years, 'U.S.' still gets the replacements," says plant foreman



Mr. James Campbell of Guyan-Eagle Coal Co., Kelly (West Va.), knows why Guyan-Eagle has been using (and replacing with) "U.S." belts for the last two decades... why today they have 17 belts operating in their 5 mines. In the words of the company's own officials, U.S. Belts are:

"The most dependable in our experience."
"Resistant to abrasive action of rock."
"Strong, durable – maintenance is minimum."

That's why, when Guyan-Eagle opened its latest mine (No. 5) it was no surprise that they equipped the system with "U.S." Belts to move the 5,000-ton daily output. *Once a "U.S." Belt user, always a "U.S." Belt user.*

The 6 "U.S." Belts in No. 5 mine range in size and capacity from the 195', 42"-wide stoker coal conveyor up to the 1700' main slope belt, a 48"-wide U.S. Giant® carrying 515 tons of ROM coal (up to 500-lb. lumps) to the shaking screens in the scalping plant. All are performing perfectly.

• • •

When you think of rubber, think of your "U.S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and the finest quality industrial rubber products.

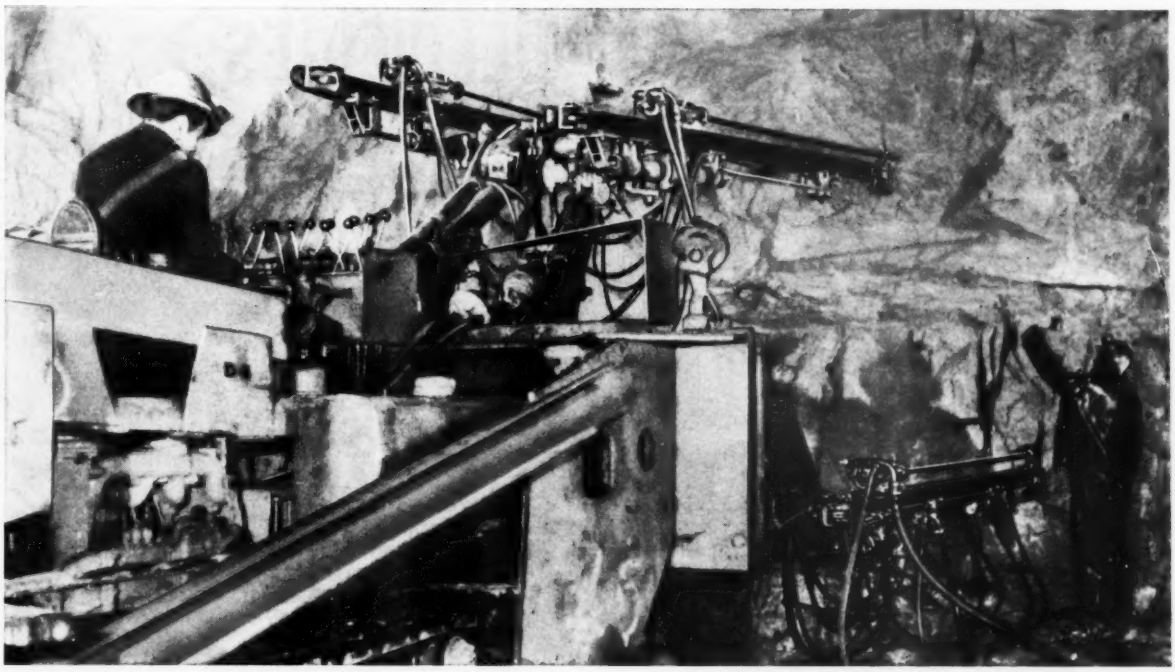
Mechanical Goods Division

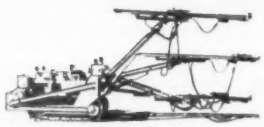
United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

HYDRA-BOOMS
speed underground drilling
in Canada's URANIUM MINING BOOM





Unlike the gold rush of Klondike days, the uranium boom in Canada's Algoma Elliott Lake area is spearheaded by the most efficient *mechanized* equipment. To speed up drilling with minimum effort, the Panel Mine of Northspan Uranium Mines Ltd. is using four Ingersoll-Rand Hydra-Boom drilling rigs, one of which is shown above, operating 1700 feet below the surface.

Each tractor-mounted rig carries three heavy-duty I-R drifter drills mounted on Ingersoll-Rand Hydra-Booms, providing smooth effortless hydraulic control of all drill motions. Booms are raised or lowered and swung from side to side and drill guides are extended, retracted, dumped and swung at the touch of a throttle—all drills easily controlled by one rig operator. Using 1⅛" round steel and 1¾" tungsten carbide insert bits, these rigs are used in a room and pillar trackless mining operation, teamed with 48" ramps mounting 30-hp I-R slusher hoists.

I-R Hydra-Booms represent the last word in *mechanized* rock drilling—convert setup time into drilling time and increase production by as much as two-to-one. Rugged, versatile and easy to operate, Hydra-Booms are designed and built to withstand the punishment and abuse inherent in underground mining operations. Swing and lift cylinders are double acting, fast moving, and locked to prevent dropping the boom if hydraulic lines are broken.

Ask your Ingersoll-Rand drilling engineer for complete, cost-saving facts about I-R Hydra-Booms. Or send for a copy of new bulletin 4196.

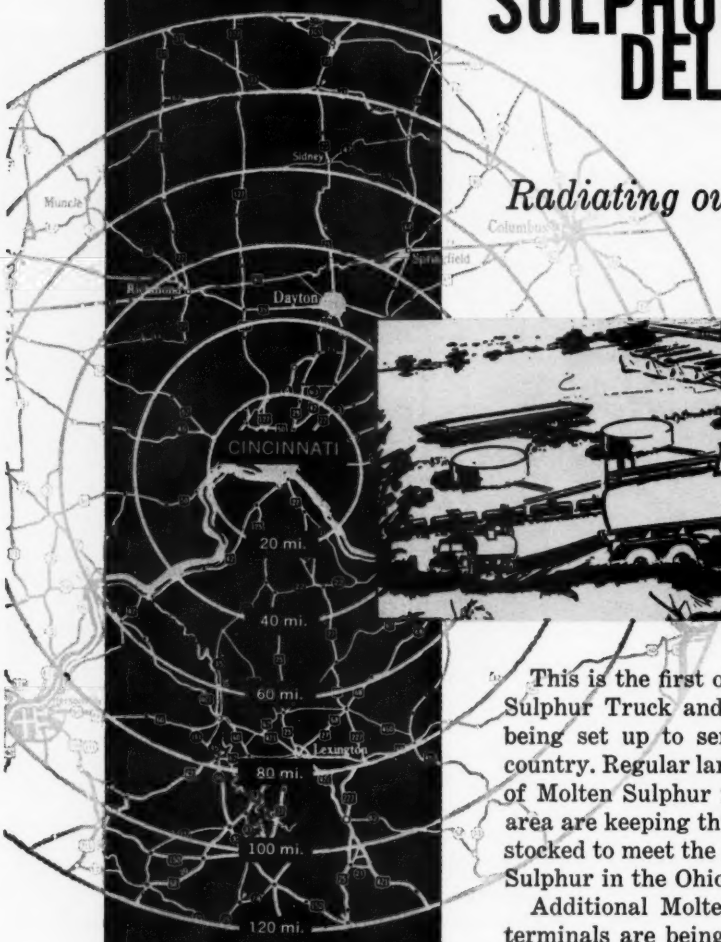
Ingersoll-Rand

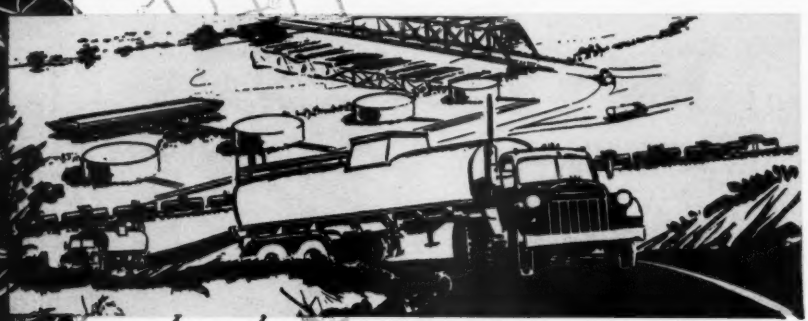
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A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

NOW....PROMPT MOLTEN SULPHUR DELIVERIES

Radiating out from Cincinnati





This is the first of the TGS Terminal Molten Sulphur Truck and Rail Distribution Stations being set up to serve industrial areas of the country. Regular large tonnage barge shipments of Molten Sulphur from our mines in the Gulf area are keeping this Cincinnati Terminal well-stocked to meet the growing demand for Molten Sulphur in the Ohio River area.

Additional Molten as well as Solid Sulphur terminals are being considered for other parts of the country.

TEXAS GULF SULPHUR COMPANY

75 East 45th St., New York 17, N. Y. / 811 Rusk Ave., Houston 2, Texas

Sulphur Producing Units: Newgulf, Texas • Spindletop Dome, Texas • Moss Bluff, Texas • Fannett, Texas • Worland, Wyoming •

Molten Sulphur in tank *cars* can be delivered to any point in the States or Canada from our nearest mine or recovery plant. Barge deliveries of Molten Sulphur are available on all navigable inland waters. Solid Sulphur, as for many years, is deliverable all over the world. Large inventories at our mines assure industry it will get its supplies when needed.

First all-new off-road truck in a quarter-century . . .



LW Haulpak®

Moves more tons per man-hour

Here it is: the revolutionary LW Haulpak . . . introduced by LeTourneau-Westinghouse after more than 3 years of research, development, and field-testing. All new from the wheels up, Haulpak gives you highest output at lowest ownership and operating costs.

Haulpak gives you a hauler built to heavy *earthmoving* standards, not merely *automotive* specifications. Many parts and assemblies are identical to those used on thousands of jobs on famous LW Tournapulls®. With Haulpak, your maintenance, repair, and operating costs will drop to a new low . . . and your hauling tonnage will climb to new highs.

Detailed specifications are ready. Ask for them!

- 22, 27, 32-ton capacities
- 290, 335, 375 hp
- Haul up to 30% more than their own weight
- Need no springs, because they ride on Hydrair* (exclusive LW air-suspension system)
- Exclusive V-body for bonus-yardage within a short wheelbase . . . plus a low center of gravity for exceptional stability
- Non-stop U-turns in far less space than conventional trucks
- Powerful, twin 3-stage hoists lift body in seconds to 70° angle for fast dump
- Lube checks of just 4 grease fittings needed only at 500-hr intervals
- Exclusive LW power-transfer differential



Although brand new, Haulpak is fully field-tested. These machines have been put through rugged tests under tough working conditions for over 14 months — in mines, quarries, and on construction jobs. Here a Model 27 Haulpak gets a heaping load on one of its "test" assignments.

*Trademark HP-2098-G-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



Continuous loading...

no spillage

acf EXTENDED-END DROP-BOTTOM MINE CARS

Extended Ends on each car catch coal that would otherwise fall between cars: the entire trip is loaded faster, without stopping the trip or the flow of coal pouring from the loading mechanism. Spillage between cars is eliminated. Haulage safety is increased.

Other special features included only in **acf** drop-bottom mine cars:

- **all-welded end sill members.**
- **double-action spring bumpers that cannot tip, flatten or crush.**
- **lubricated doors for easy, positive action with faster unloading.**

Forty years of **acf** experience in mine car design and manufacture back up the **acf** Representative. He can give you full information on all sizes and types of mine car from 2 to 30 tons and larger. Why not discuss your haulage requirements with him? Just call your nearest **acf** Sales Office.



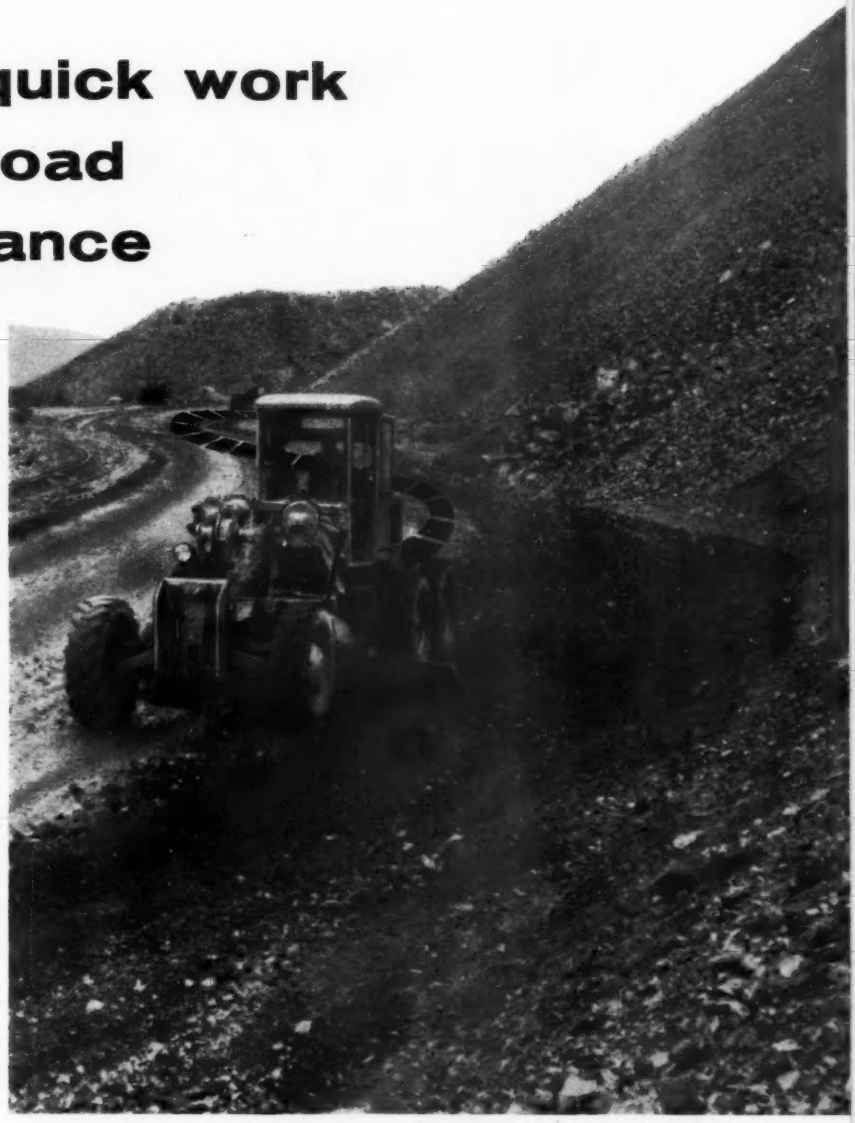
Bulletin describing all types of **acf** *Mine Cars available on request.*

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AMERICAN CAR AND FOUNDRY
DIVISION OF ACF INDUSTRIES, INCORPORATED
750 THIRD AVENUE, NEW YORK 17, N.Y.

MINE CARS FOR CONSTANT HAULAGE

SALES OFFICES: New York • Chicago • Cleveland • Washington, D. C. • Philadelphia • San Francisco • St. Louis • Berwick, Pa. • Huntington, W. Va.

Makes quick work of haul-road maintenance



Powerful L-W Adams 660 — at large open-pit mine in Arizona — patrols busy haul roads 24 hr a day, 6 days a week. Grader goes wherever needed (at speeds to 26 mph) to fill ruts, level washboard, clear debris dropped by overloaded haulers and improve drainage.

You know from experience that using the *right* tool on any job completes the work faster and easier. The same holds true when maintaining your haul roads, pit floor, dump areas around crusher, and stockpiles, or waste dump. Use a heavy-duty L-W Adams† grader for these maintenance assignments. You'll find you can complete this work *faster* and *at lower cost.*

Greater work range

All LeTourneau-Westinghouse 80, 115, 123, and 160 hp Adams graders have constant-mesh transmission as standard, with 8 forward and 4 reverse speeds. In addition, 3 optional creeper speeds provide extra lugging power for turning up rocky subsurfaces and for greater grading accuracy. Choice of 15 gear ratios give you the balance of power and speed to handle every grading job . . . in any material . . . at top efficiency.

Smooth, accurate control

Adams' blade mechanism is firmly mounted on a heavy-duty circle for chatter-free operation. Strong T-shaped drawbar gives L-W grader firm circle support for accurate blading in any material.

Blade positioning is fast . . . it swings maximum arc from deep ditch-cut to high bank-cut in less than a minute. Moldboard turns 360° — clockwise or counter clockwise — provides quick change from any forward work position, to desired angle for reverse ditching and grading.

Low operating costs

All gears operate on anti-friction bearings — for less wear, easier operation. Automatic braking on transmission, when hydraulic brakes are applied to wheels, gives safer operation and less maintenance. And because L-W power-control clutches shift on ball bearings, you have easier, smoother, safer controls . . . assuring accuracy, speed, and performance with minimum upkeep.

Keeps busy all year

Between regular assignments, your LeTourneau-Westinghouse grader need not sit idle. With available attachments, such as Jebco Elegrader, bulldozer blade, scarifier, snow plow and wing, you can keep this grader busy on your property the year round. Also, grader's high travel speeds (to 26 mph) permit the profitable handling of jobs for adjoining pits. There are 7 Adams models — 60 to 190 hp. Your choice of GM or Cummins engines on 6 larger models. 190 and 135-hp POWER-*Flow*® models have torque-converter drive . . . will do more work faster than any other graders on the market. Call or write for a demonstration today!

†Trademark G-1874-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

A MAJOR BREAKTHROUGH IN FINE COAL CLEANING

The Dutch State Mines

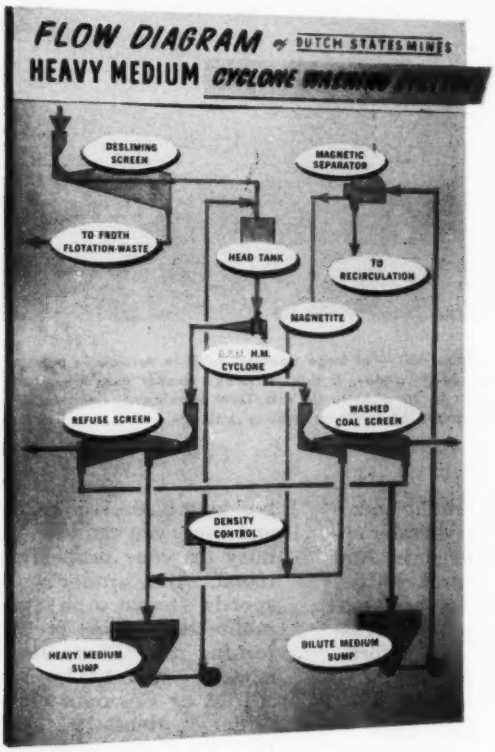
HEAVY MEDIUM CYCLONE WASHER

for fine coal, ¾ inch to 48 mesh



Did you see the Hit of the Show?

Cleans coal cleaner with lower ash and higher Btu at any specific gravity you want . . . greater recovery than with any other cleaning system regardless of size distribution, particle shape or percentage of near gravity material.



The completely new heavy medium cyclone washing system is now, for the first time, available to coal producers in the United States—and *exclusively through Roberts & Schaefer.*

With positive control and laboratory efficiency on a production scale, you can increase recovery of fine coal and deliver a better quality product to your customers.

You can make an effective separation anywhere in the specific gravity scale and produce the quality coal your market demands.

Whether you are planning a new plant or are interested in the possibilities of improving the quality of your fine coal output, it will be worth your while to get the pertinent facts about the revolutionary heavy medium cyclone washing system.

A Roberts & Schaefer engineer will be glad to discuss this with you at your convenience.

ENGINEERS & CONTRACTORS

ROBERTS & SCHAEFER *Company*

201 NORTH WELLS STREET, CHICAGO 6, ILLINOIS

NEW YORK 19, N.Y. • PITTSBURGH 22, PA. • HUNTINGTON 10, W. VA. • ST. PAUL 1, MINN.



Traction motors take 1000 volt jolt underwater at National

The Specialists in electric coils...repair/service

National Electric Coil now rewinds traction motor armatures with NECCOBOND coils and vacuum impregnates in Epoxy resin. This combination offers you longer life and more dependable motor service because of these reasons:

- high thermal stability
- outstanding electrical properties
- cooler operating temperatures
- excellent mechanical strength
- inertness to water, chemicals, greases.

So effective is the National system that both field coils and armatures pass a 1000 volt d.c. test while immersed in water. Several armatures have been left underwater several weeks without a significant reduction in insulation resistance.

If you want the kind of superior performance that this insulation system makes possible, contact National for your renewal or modification needs.



For more information call National's Columbus plant...HUdson 8-1151, or call the nearest National field engineer.

National Electric Coil

DIVISION OF McGRAW-EDISON COMPANY
COLUMBUS 16, OHIO

McGRAW EDISON

ELECTRICAL ENGINEERS • MANUFACTURERS OF ELECTRICAL COILS, INSULATION, LIFTING MAGNETS • REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

Harmattan Mine coal haulers have been using STANOLUBE HD-M Motor Oil for 10 years --here's why

Pick a spot on the haulage road. Every three minutes one of the Harmattan Mine's ten 40-ton coal haulers passes the spot on the way to the preparation plant. These coal haulers have used STANOLUBE HD-M Motor Oil for ten years for these reasons:

Product: STANOLUBE HD-M Motor Oil is refined from the highest quality base stock. Blended into this carefully refined base oil are additives that retard oxidation, minimize piston ring deposit formation and prevent the forming of excessive varnish and sludge. Other additives prevent corrosion of bearing metals and eliminate bronze wrist-pin bushing corrosion.

Technical Service: Fred Barnes, who has 22 years' experience providing lubrication technical service at Standard Oil, calls on Harmattan Mine. He lives at Decatur, only



Harmattan Mine truck foreman Ralph Westfall and Standard's Fred Barnes inspect coal hauler piston. Prior to his 22 years' service providing technical assistance on lubrication problems, Fred Barnes attended James Millikin University. He has also completed the Standard Oil Sales Engineering School.

80 miles from the mine. Fred is on call at any time to get to the mine and render assistance on any problem involving lubrication engineering.

Deliveries: A Standard Oil agent located only five miles from the mine delivers lubricating oil, is handy for regular deliveries and for special deliveries at a moment's notice. The mine management never needs to worry about inventories of STANOLUBE HD-M. Their Standard Oil agent takes care of that.

Would you like this kind of service for your coal mining equipment? It's at your doorstep anywhere in the 15 Midwest or Rocky Mountain states. Call your nearby Standard Oil office. Or contact by letter, wire or telephone: **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**



One of the biggest draglines ever built is this Bucyrus-Erie unit. It is one of two in service at Harmattan Mine. Both are Standard Oil lubricated.



Every three minutes one of these 40-ton coal haulers moves down haulage road to preparation plant. STANOLUBE HD-M Motor Oil stands up to the tough service imposed on it. Dirt, adverse road conditions, hot engine operation and heavy-load—no-load service cannot lick this oil.

Quick facts about
STANOLUBE HD-M Motor Oil

- Refined from highest-quality base stock.
- Contains special additives that prevent bearing and bronze wrist-pin bushing corrosion, reduce piston ring varnish and keep rings free to seal against blow-by.
- Contains still other additives that reduce wear on heavily stressed parts.

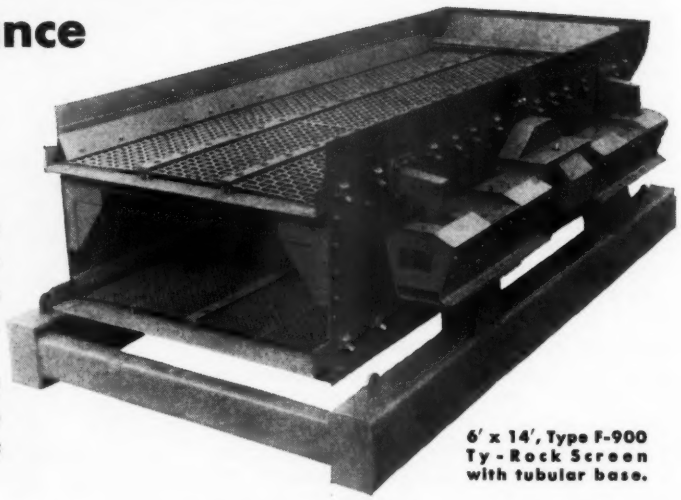
You expect more from **STANDARD** *and you get it!*

For TOP Performance

TY-ROCK SCREENS

The balanced circle-throw action of the Ty-Rock plus the full-floating action on large shear type resilient rubbers enables this screen to separate material with unequalled speed and effectiveness.

The Ty-Rock wastes no power in useless, harmful racking of buildings or supporting members. It delivers all of the intense power to the job of stratifying and separating the sizes.

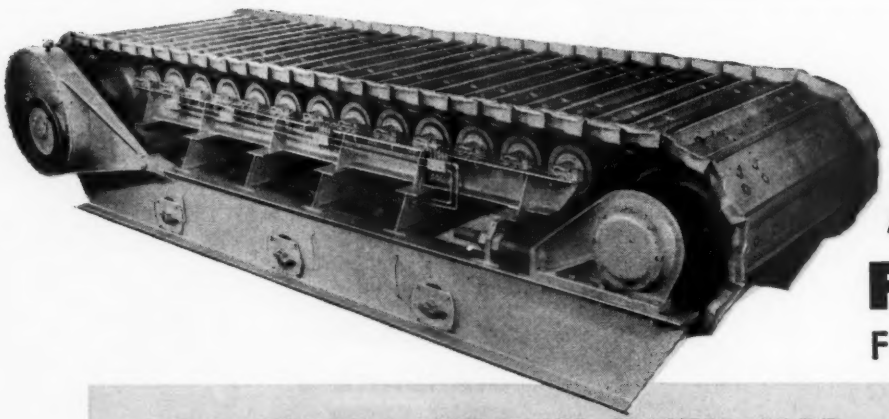


6′ x 14′, Type F-900 Ty-Rock Screen with tubular base.

Telephone **HE 1-5400** • *Teletype* **CV 586**

THE W. S. TYLER COMPANY, CLEVELAND 14, OHIO

Manufacturers of Tyler Double Crimped Wire Cloth, Ton-Cap and Ty-Rod High Capacity Screens, Hum-mer Electric Screens, Tyler-Niagara Screens. Ty-Rock and Ty-Rocket Screens, Tyler Standard Screen Scale Sieves, Ro-Top and Ty-Lab Sieve Shakers.



NICO

APRON FEEDERS

FD-4 and FD-8

FOR EXTRA HEAVY DUTY USE

- Uses Mass Produced Standard Crawler Tractor Parts
- Short Pitch, 8" on FD-8, 6-¾" on FD-4, provides more even feed.
- Decks of Cast Manganese or Formed Alloy Steel
- Large Diameter Head and Tail Shafts
- Anti-Friction Self-Aligning Bearings
- Centralized Lubrication Available
- Uses NICO Shaft Mounted Reducer . . .

Eliminates open gearing and lubrication problems

Write for Illustrated Brochures

NATIONAL IRON COMPANY

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Duluth 7, Minnesota

SUBSIDIARY OF PETTIBONE MULLIKEN CORP., CHICAGO 51, ILLINOIS

Du Pont Announces Major Improvements in Safety of Permissible Blasting

Du Pont High Salt Permissibles

On the basis of investigations conducted by the U. S. Bureau of Mines, all Du Pont permissible dynamites now contain 10% of salt. This flame-cooling agent significantly reduces the chance of a gas or dust explosion due to misuse of the explosive.

Permissible explosives in the United States have a marvelous safety record. The Bureau of Mines states that no permissible, when used in a permissible manner, has ever caused a coal mine disaster. Some gas and dust ignitions have occurred, however, when human failure resulted in non-permissible conditions of use.

Du Pont's adoption of 10% salt in its permissible dynamites substantially reduces the risks involved in human failure. Our interpretation of the Bureau of Mines data indicates a reduction of about 50% in the tendency to ignite coal gas.

The inclusion of salt has no effect on the strength, sensitiveness, or any other explosive property of Du Pont permissibles.

This has been established conclusively in a year of extensive field use throughout the country.

Permissible Multiple Firing with Du Pont MS Delays

Many hard rock mining and quarrying operations have increased safety and economy by using multiple firing with short-interval delay electric blasting caps. Permissible, short-interval delay blasting with Du Pont MS Delay Electric Blasting Caps can bring these same advantages to coal shooting.

Increased Safety. Short-interval delay blasting reduces exposure to dust, fumes, smoke and coal falls, since it is unnecessary to re-enter the room until all shooting is completed. It is easier on roof and ribs, so it reduces the hazard of roof and coal falls.

Increased Economy. Permissible multiple firing will cut production costs as well as increase safety. Reduced shooting time produces more coal per man-hour. Improved displacement gives better loadability. And this more efficient blasting gives a lower powder factor.

New Permissible Blasting Machine

A new Du Pont 20-shot permissible blasting machine has been designed specifically for short-interval delay blasting in coal mines. It is authorized by the U. S. Bureau of Mines for firing up to twenty 16-foot, iron wire MS Delay Electric Blasting Caps.

More information

For complete information on how Du Pont's new high-salt permissibles, MS delays, and permissible blasting machine can increase the safety of your operations, call your Du Pont representative or write directly to Du Pont, Explosives Department, Wilmington 98, Del.

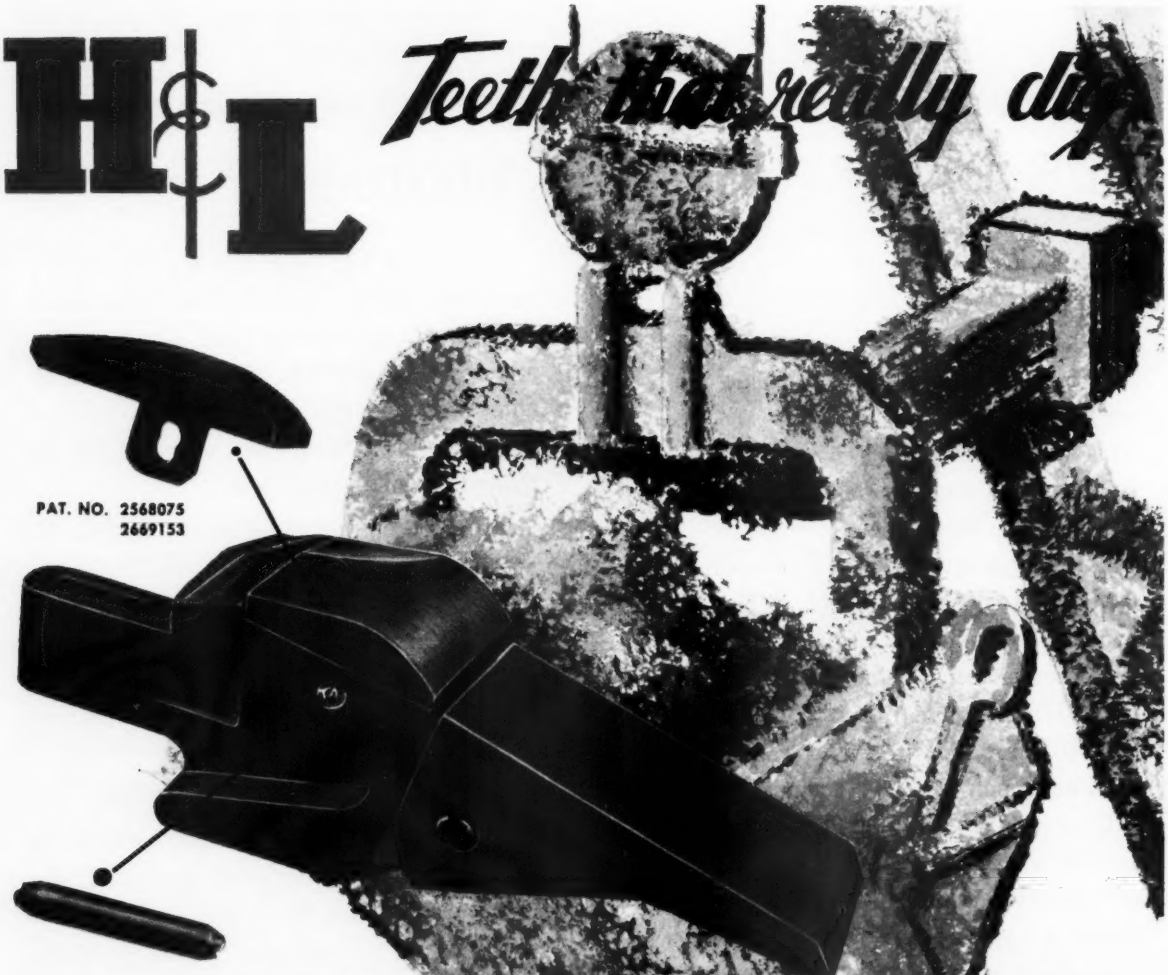
DU PONT EXPLOSIVES

REG. U. S. PAT. OFF.

Better Things for Better Living . . . *through Chemistry*

H&L

Teeth that really dig



FORGED ALLOY STEEL ADAPTER WITH REPLACEABLE POINT AND RENEWABLE WEAR-PLATE — FOR ALL SHOVELS... 2½ YD. CAPACITY AND LARGER.

SEE YOUR H&L DEALER
or write:

H&L **TOOTH COMPANY**
1540 SOUTH GREENWOOD AVENUE
MONTEBELLO, CALIFORNIA

QUALITY and SERVICE
That Has Maintained Leadership For Over 28 Years

Questions

We've been asked about the Yieldable Arch

"When using Yieldable Arches as we advance a drift, is it necessary to install temporary props for support?"

Not at all. You can usually install the Yieldable Arch right next to the breast of the drift. This brings the overburden under immediate and permanent control, without the time and expense of temporary roof support.

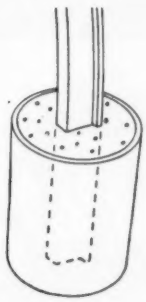
And we do mean *control*, for as soon as the surrounding forces bear down too hard, the Yieldable Arch will "give" a little, instead of collapsing. This allows the overburden to settle gradually until it forms a natural pressure arch around the mine opening.

In cases where the ground is heavy, or otherwise bad, forepoling or spiling will give immediate protection while the Arch is being installed.



"What kind of base or footing should be used with the Yieldable Arch?"

If the bottom of your drift is definitely firm, you can set the Arches directly on the rock itself. Otherwise you should set them on footings. Wood blocks are frequently used for this purpose; so are short pieces of steel plates, channels, I-beams or other steel "leftovers."



If an acid water condition exists in your mine, it's well to set the Arch legs in concrete. A short length of pipe will serve as a permanent form in which to pour, as shown in the sketch.

"What is the recommended placement of Yieldable Arch sets in curving drifts?"

Curves present no special problems. Place the sets radially, with the normal strut spacing on the *outside* of the curve. Struts for the inside of the curve are simply cut to suit the reduced spacing.

In the case of a pitching drift, Yieldable Arches should be placed perpendicularly to the drift, not vertically. This makes lagging easier, and also tends to distribute loads more uniformly.

SEND US YOUR QUESTIONS

Send in your questions concerning the application of the Yieldable Arch or Ring to your mine. We will study your problem and reply as promptly as possible. Write Room 1041, at the address below.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

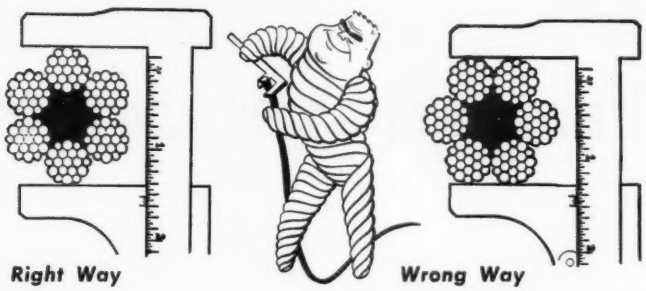
BETHLEHEM STEEL

BETHLEHEM STEEL

Tuffy® Wire Rope Tips

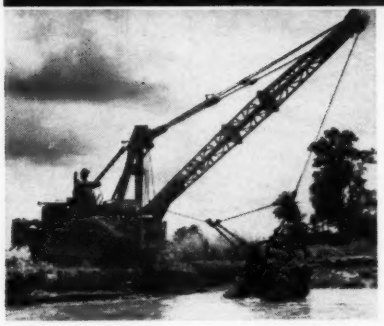
When Sheaves, Sockets and Clips Misfit... Your Pocketbook Will Be Hard Hit

How to Measure Rope Diameter



To get the most service, efficiency and safety out of wire rope operation, rope and sheaves must be precisely fitted to each other. There's only one right way to measure rope diameter: use machinist's calipers and be sure to measure the **widest diameter.**

A slight shift of the rope in the calipers, as shown above, will give you a misreading which would result in ordering an undersize rope. Note that the measurement at right shows ⅛" under correct diameter. Be sure to double-check every time!



Tuffy Balanced Dragline Rope



Here's highest abrasive resistance with super flexibility. Better spooling. Smoother riding on grooves. And Tuffy Dragline Rope hugs the drum when casting for full load. Gives you longer service life, consistent dependability, in handling any material — wet or dry dirt, sand, gravel, rock, cement or minerals.

How to Check Groove Diameter



No Go



Just Go

Groove diameter of a sheave or drum must never be less than the actual calipered diameter of the new rope. When a new rope is installed on old equipment, use a reliable groove gauge to make sure the tread or bearing surface of all sheaves is of sufficient size to avoid pinching the rope.



Kick Out Worn Sheaves

Old sheaves may never die, but in "fading away" they develop conditions which shorten rope life. Sheaves with grooves corrugated with rope lay impressions should be replaced with new ones before new wire rope is installed.



How to Measure Tread Diameter



Easy, and important. Select the smallest sheave or drum to be used with the new wire rope, and measure actual diameter at lateral center (shortest dimension) of tread.



Tuffy Balanced Slings & Hoist Lines



"Balanced" because they combine strength, flexibility and toughness in the proper relationship to do a better job longer.

Tuffy Slings and Hoist Lines are a top-performing team in every type of materials handling. The slings are made of a patented, machine-braided fabric that's next to impossible to knot or kink. The hoist lines are a special construction in which strength, flexibility and toughness are balanced.



Tuffy Balanced Scraper Rope



"Balanced" construction makes it flexible enough to withstand sharp bends, yet stiff enough to resist looping and kinking when slack. Also gives higher resistance to the shock of load impact on slack line. Moves more yardage per foot because it's specially built to take the beating of drum-crushing abuse.

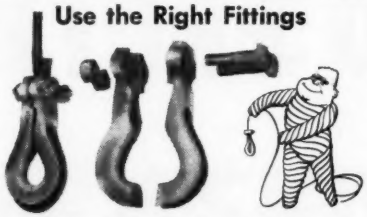


Tuffy Balanced Dozer Rope



Built to give you longer service with less downtime. Mounted on your dozer, a 150' reel of ½" or 9/16" can give you a big bonus of extra service. Here's how: when rope shows drum wear or is crushed on the drum, you feed through just enough to replace the damaged part. You save the 40 to 50 feet ordinarily thrown away. Also available in 300' and 500' reels.

Use the Right Fittings



Right fittings add life expectancy to wire rope. Fittings which derive holding power from crimping action are harmful.

Shown here is a clamp that has no "wrong side"—can be put on either way. It snugly saddles the rope, grips larger surface area in such a way that loads are carried almost entirely by friction instead of crimping action. Combined in its two parts is a thimble. The parts are interlocked to prevent collapse of the thimble and eliminate all shear on the bolts.

Recommended sizes:

Diameter of Rope	Min. Dia.	Max. Dia.
¼-⅝	+ 1/64"	+ 1/32"
⅜-¾	+ 1/32"	+ 1/16"
⅞-1⅛	+ 3/64"	+ 3/32"
1¼-1½	+ 1/16"	+ ⅛"
1⅝-2¼	+ 3/32"	+ 3/16"
2⅜ and larger	+ ⅛"	+ ¼"



New ropes are usually over-size. It is advisable to have groove diameters of sheaves or drums as large as the actual calipered diameter of the new rope, or slightly larger. We recommend sizes as above charted.

9 Steps to Correct Socketing



1. Securely seize and serve with soft wire ties before cutting, and have at least two additional seizings placed at a distance from the end equal to the length of the basket of the socket.
2. When the rope is properly seized, take off the end seizing. Cut the fiber center back to the seizing, as shown in 1 above. Untwist and broom out the wires. See illustration 2.
3. Clean the wires for the distance they are to be inserted in the socket. Use benzine, naphtha, gasoline or other solvent. Then wash off in boiling water or boiling ammonium chloride used in Step 5.
4. Then dip cleaned wires in commercial muriatic acid to a depth not greater than ¾ of the cleaned length of wire. Keep the wires immersed for 3 minutes, or until the acid has thoroughly etched each wire. Be sure acid does not contact any other portion of rope.
5. Immerse wires into boiling ammonium chloride. A white coating will be left on the wires.
6. Place a temporary tie wire over the ends of the cleaned wire (see illustration 3). Be careful not to get the cleaned wires greasy or oily.
7. Insert the rope end into bottom of socket. Remove temporary tie wire.
8. Holding the rope vertically in a vise, set the socket so that the wires are flush with top of the socket basket and seal the bottom with putty or clay (See illustration 4). Pour in among the wires about ½ teaspoon of sal ammoniac crystals.
9. Pour molten zinc into the basket until it is full (see illustration 5). When zinc is solidified, the seal is removed and socketing complete as shown in illustration 6. The zinc must not be too hot or it will anneal the wires, particularly of small ropes. Temperature must not be above 925° F. Use pine stick test: if stick chars but does not ignite, the zinc is ready to pour. Overheated zinc will have a red color and stick will catch fire. When zinc has solidified sufficiently, the socket may be plunged into cold water.



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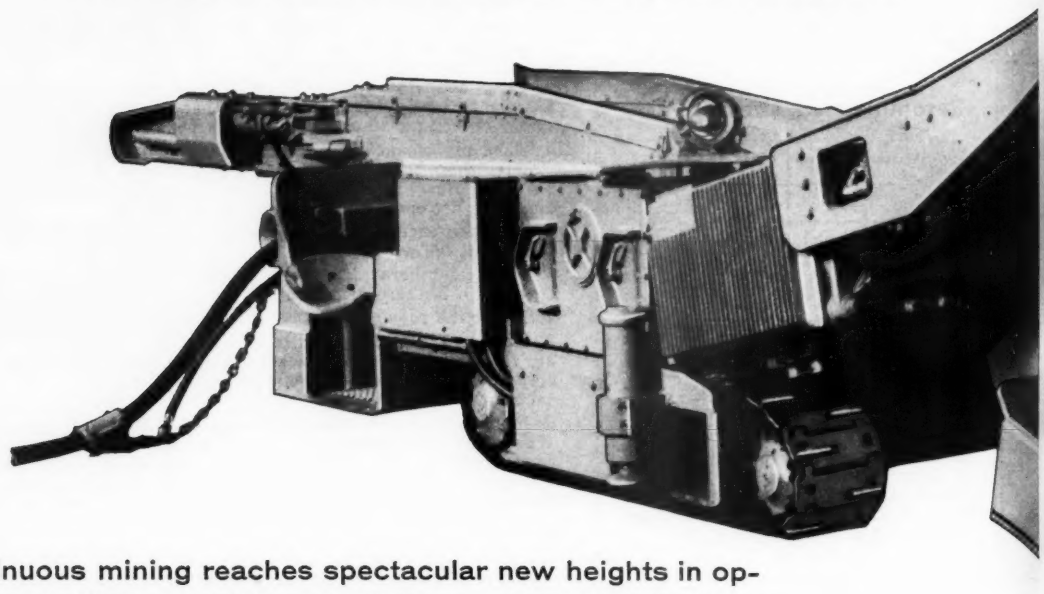
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2

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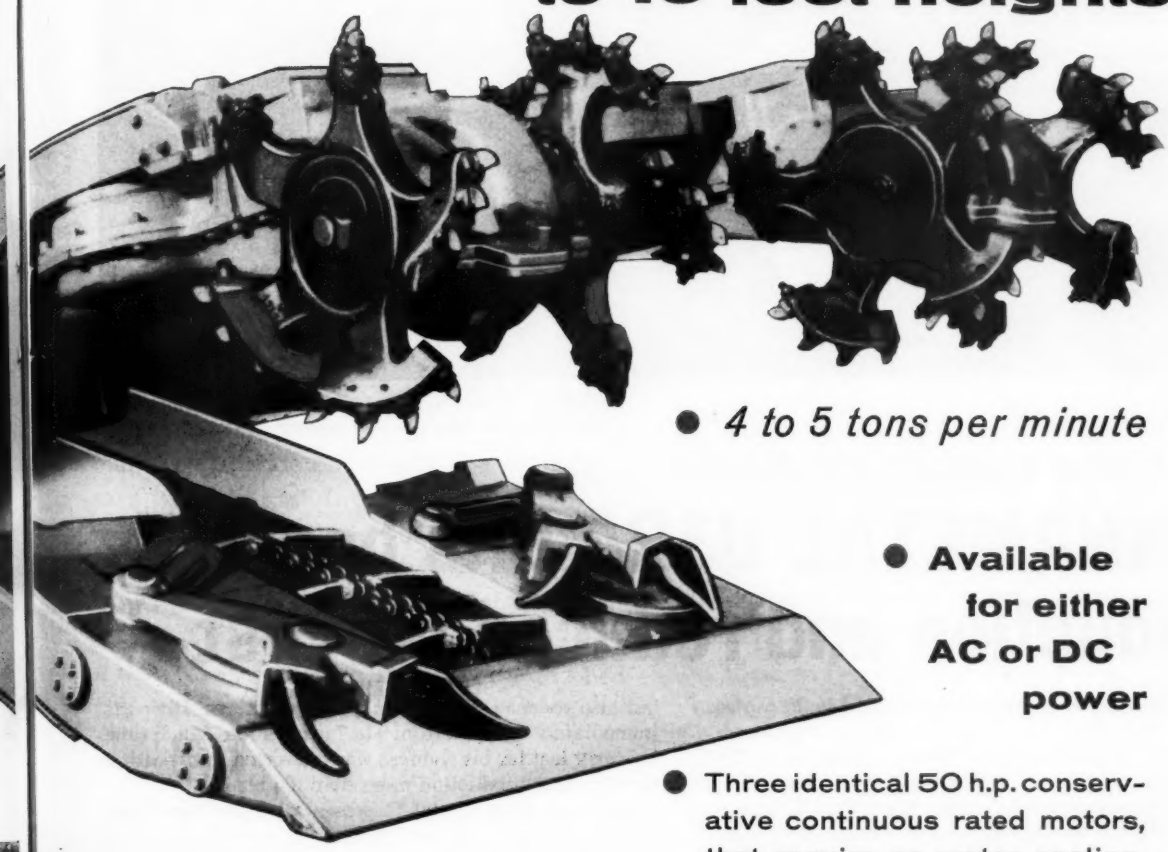
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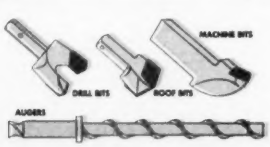
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	Bits changed per shift	Tonnage per shift	Bit cost per ton
Standard carbide bit	200	225-240 tons	67¢
Hardfaced steel bit	300	175-218 tons	33¢
Kennametal U3RA bit	150	435-652 tons	27¢

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EDITORIALS

ROBERT W. VAN EVERA, Editor
AUGUST 1959

Erosion of the Tax Base

The House Ways and Means Committee has announced that in November it will hold panel discussions with the objective of broadening the tax base. There are many who allege that the percentage depletion provisions of the Internal Revenue Code have contributed to "erosion of the tax base" and that a reduction of the depletion allowance, together with tightening of "loopholes," would lessen the general tax load.

With the heavy tax load already imposed upon our economy, we believe that attempts to balance the budget should be directed primarily at reduction or elimination of unnecessary expenditures. In our system of government, however, this can not be achieved until everyone fully understands that the Federal Government is merely a conduit—not a source —of money. Until enough voters realize that it is they who pay for Federal handouts and Federal waste, our political system can not avoid such handouts and such waste.

In the meantime, any harsher tax treatment of the mining industry will result in true "erosion of the tax base." The speculative nature of the mining industry, the special tax problems inherent in the disposition of wasting assets, the high proportion of mining ventures which never "pay off," and the high maintenance costs which make it uneconomic to suspend operations during periods of low demand, all tend to make mining an unattractive investment for risk capital. Increasing the tax load on mining might well make risk capital unavailable to the mining industry, stop further exploration for natural deposits, and cause abandonment of many of the marginal mines presently operating.

If this should be allowed to happen, the Nation might find the general level of the economy so reduced as to make it impossible to collect necessary revenues no matter what taxes were imposed. America is rich in natural resources, and the utilization of those resources has made America an industrial nation of wealth and power unmatched in history. Harsh tax treatment could easily destroy the availability of the minerals which are essential to the maintenance of a dynamic and expanding economy.

Build a Better Mouse Trap

Ralph Waldo Emerson is generally credited with authorship of the well known adage "Build a Better Mouse Trap and the World will Beat a Path to your Door," and we think he really had something.

According to a report of the U. S. Bureau of Mines, which we recently had occasion to study, last year an average of 3,002,738 roof bolts were set each month in the coal mines of our Nation. It is true that about 7.5 percent of these were reclaimed bolts, but even eliminating these, a whopping 2,782,550 new bolts were used monthly. To this figure can be added an estimated million bolts being installed monthly in metal and non-metallic mines.

When one considers that this means equipment is needed to drill over four million holes monthly, as well as to tighten bolts, the picture of this business of roof bolting assumes major proportions.

The benefits of supporting mine roof with bolts have been manifold, and so obvious that the industry accepted the technique with amazing speed. It is hard to believe that just 12 short years ago this technique was, for all practical purposes, nonexistent. For the mining industry, roof bolting has certainly proved to be "a better mouse trap."

Face Ventilation and Dust Control with Continuous Mining Machines

By
JOHN B. KEBBLISH
General Superintendent
Mountaineer Coal Co.

Effective face ventilation in continuous mining machine sections is an important problem facing many companies operating in gaseous coal seams. Here are the results of Moutaineer Coal Company's efforts to improve its face ventilation techniques at the modern Loveridge mine

THE main factor in practically all face ventilation problems is the intensity of methane liberations.



This is the primary problem at Mountaineer Coal Company's new Loveridge mine in northern West Virginia. Underground workings are in the development stage in a virgin and gaseous area of the Pittsburgh seam.

In addition to methane liberations, effective face ventilation is complicated by the use of boring-type continuous mining machines. Moving large volumes of air to the face area is a problem with any type of production equipment, but the problem becomes more acute when confronted with the narrow (12 ft 8 in.) entry driven by the boring-type machine.

Initially, a ripper-type machine was used for development work, but with a rather weak roof overlying the coal seam and the relatively wide headings driven by the unit, roof control became a critical problem. Even though roof bolts were used for initial support, approximately 80 percent of the headings either fell in or required additional support.

In an effort to control roof conditions, a boring-type machine was tried and proved to be immensely successful. Not a single major fall has occurred during the past two years in the boring-type machine headings. At present, two of these units are in operation on a triple-shift basis.

Proper face ventilation is especially important at Loveridge because of a generous sprinkling of sulfur intrusions, pyritic lenses, etc., in the coal seam. The sparks from these impurities, when struck by cutting bits, are a source of ignition.

Line Brattice Installations Prove Inefficient

The company's first approach to this face ventilation problem was with line brattice installations. During initial stages of development in the bottom and rotary dump area, working places could be ventilated, at various times, as shown in figure 1.

Air quantity at the crosscut was not a problem. Only one boring-type machine was in operation and the major portion of the 260,000 cfm exhausted from the mine was available to ventilate the machine, if needed. However, with 80,000 cfm in the crosscut, only 4000 cfm reached the end of an 80-ft line brattice using No. 10 brattice cloth. Shuttle car haulage did not pass through the line brattice and a tight curtain was maintained in the crosscut. Even so, 95 percent of the available air was lost before it reached the face area. In spite of enormous leakage losses, air velocity at the end of the line brattice was 500 fpm and 135 fpm at the face. This was sufficient for good face ventilation where the methane liberation was less than 40 cfm at the immediate face. Liberations from the roof and ribs on the return side were more than adequately diluted by the air leakage through the line brattice.

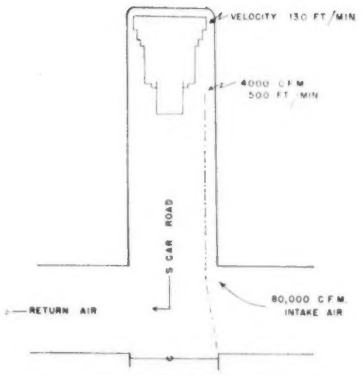


Fig. 1. During initial stages of development in the bottom and rotary dump area of Loveridge mine, working places could be ventilated, at various times, with the line brattice installation shown. Note that 95 percent of the available air was lost before it reached the face area

In working places liberating greater amounts, two and three layers of brattice cloth, a plastic material or canvas were used to decrease air leakage.

Figure 2 shows the method used for line brattice installations. To prevent damage by the loading machine operating behind the continuous mining machine, the lower part of the line brattice is fastened, using spads, about 14 in. up on the rib. A little slack is maintained in the cloth before fastening at the top so that air pressure will billow out the line brattice and provide a larger area for air flow to the face. Cross-sectional area is approximately six sq ft.

Mine Standardizes on Double-Split System of Ventilation

However, face ventilation as shown in figure 1 is rarely encountered. The company has standardized on a double-split system of ventilation (figure 3). Intake air enters the working section in the center headings between stoppings, splits in the center of the section and returns in airways on both sides of the section. The battery of eight headings shown in figure 3 are being driven to serve as main intakes. Another set of eight headings will be driven parallel to these and serve as main return airways. The three return airways as shown are only temporary and not of great length. However, the stopping line between No. 7 and No. 8 headings will be maintained and No. 8 heading will serve as a bleeder return, preventing liberations of methane from entering the intake air from the solid virgin coal adjacent to No. 8 heading.

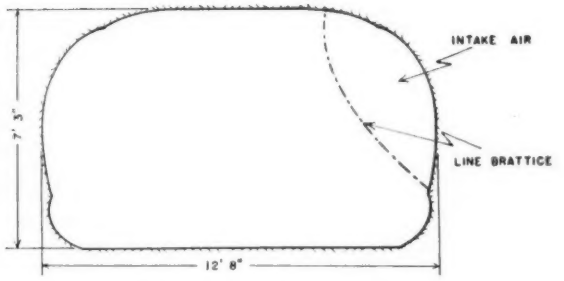


Fig. 2. The lower part of the line brattice is fastened about 14 in. up on the rib to prevent damage by the loading machine operating behind the continuous mining machine

Using line brattice on the intake side, the situation normally encountered is as shown in figure 4. With shuttle car haulage through the curtain at the crosscut, air leakage was so excessive that it was very difficult to maintain a safe atmosphere at the working face.

To eliminate haulage through the line brattice and subsequent air leakage, the line brattice was installed on the return side (figure 5). Close clearance around boring-type machines limited line brattice extension to the back end of the machine—some 20 ft from the face. Because the area behind the line brattice was restricted, large volumes of air could not be forced to the face area. It was also found that air velocities along the line brattice were much greater than along the far rib. In addition, short-circuiting of air across the continuous mining machine directly into the return practically eliminated air movement in the far corner of the working place and across the face.

The final step taken to improve face ventilation, using line brattice, was the installation of a door in the shuttle car haulway (figure 6). Even though this proved to be the most effective line brattice method, it was still inadequate when large methane liberations were encountered.

The small area available for intake air in the working place drastically limited the amount of air that could be forced to the face. In addition, the door acted as a regulator and the volume of air in that particular split was reduced by as much as 50 percent. During the period that the door was open, operation of the continuous mining machine ceased. The face was then rechecked for gas before operation resumed.

Another method of ventilating the face was the installation of a door in the next outby crosscut (for shuttle car haulage) with a tight line brattice in the last open crosscut. This system too was ineffective when large liberations were encountered.

Following is a summary of the various disadvantages of line brattice installations:

1. Unsatisfactory face ventilation when large methane liberations are encountered.

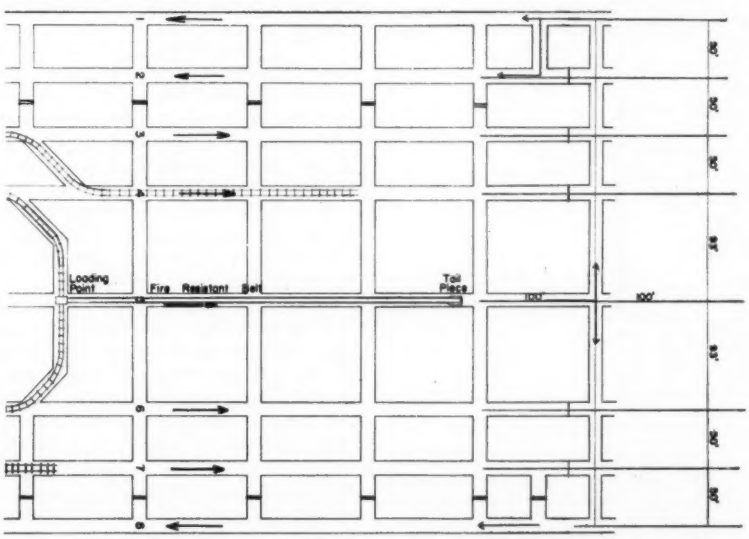


Fig. 3. Development projections—intake headings. The company has standardized on this double-split system of ventilation

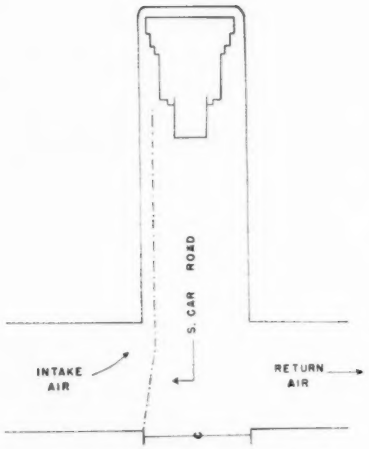


Fig. 4. Using line brattice on the intake side

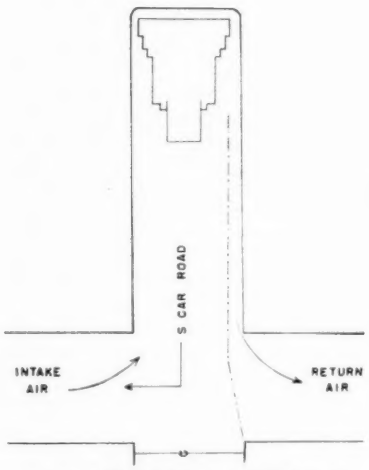


Fig. 5. To eliminate haulage through the line brattice (as shown in figure 4) and subsequent air leakage, line brattice was installed on the return side

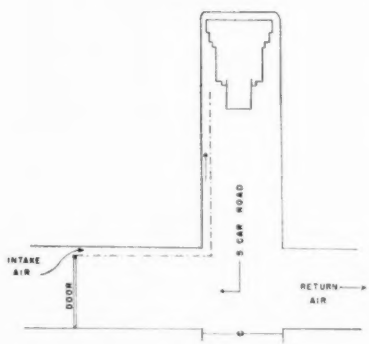


Fig 6-Line Brattice With Door Installation

Fig. 6. Final step taken to improve face ventilation, using line brattice, was the installation of a door in the shuttle car haulway. Even though this proved to be the most effective line brattice method, it was still inadequate when large methane liberations were encountered

2. Huge volumes of air are required to overcome excessive air leakage. As much as 180,000 cfm has been measured at the mouth of the section. Based on these figures, total air requirements for a given operation would be completely impractical to obtain.
3. Line brattice installations introduce exceedingly high resistance into any ventilation system, thereby reducing the quantity of air in circulation.
4. Workers in the face area were required to work in very dusty conditions.
5. Objectionable amounts of fine coal dust produced during mining operations hang in suspension or settle out in the face area where ignitions are more prevalent.

Auxiliary Fans, Tubing Offer More Positive Ventilation

To overcome the deficiencies of line brattice installations, experiments with auxiliary fans and tubing were conducted jointly with the U.S. Bureau of Mines at Loveridge mine.

Figure 7 illustrates a blower system using a 1½-hp, 12-in. diam. fan capable of producing 2600 cfm free flow. With 100 ft of 12-in. tubing, about 2000 cfm is discharged at the end of the tubing. For working places with methane liberations up to 20 cfm this method did a very good job of keeping the face clear of gas, even with the end of the tubing as much as 35 ft from the face. For liberations greater than 20 cfm, larger fan and tubing capacities would be required.

The main objection to this system was the heavy concentration of dust in the working area. Another disadvantage, but not too important, was the necessity of cutting fan "shelter holes" in the crosscut. Safe clearance was not available in the narrow boring-type heading to place the fan along the normal rib in the shuttle car haulway. With a wider heading there would be no problem.

Using the blower system, care must be taken when checking for gas. Maximum concentrations are found at the mouth of the working place—not at the face. The methane content of the air will continue to build up after leaving the face due to liberations from the ribs and roof. This is in direct contrast to line brattice installations where excessive air leakage more than adequately dilutes liberations from the roof and ribs. With well installed tubing, leakage is very small.

An exhaust system using 18-in. tubing with a 5-hp, 18-in. fan is shown in figure 8. The fan is capable of producing 6700 cfm free flow. With 100 ft of tubing, approximately 5000 cfm was measured entering the tubing. With the end of the tubing seven to ten ft from the face, dust control in the face area was excellent, but the far corner would tend to gas up. With the end of the tubing 15 to 25 ft from the face, dust control was still good, but at this distance the entire face area would gas up.

Another objection was the difficult installation of the 18-in. tubing near the face between the boring-type machine and the rib. Objectionable too was the obstructed view and working space of the machine operator when the large tubing was installed on the operator's side of the heading.

A combination system (figure 9) using both the blower fan and exhaust fan did an excellent job on methane liberations at the face. But, because only a portion of the total air moves up the heading (part through the tubing) at a relatively low velocity, stratification of methane occurs when fairly heavy liberations are encountered. Methane can be detected near the roof behind the continuous mining machine before it is detected at the face.

Dust control with this system was not as good as with exhaust tubing alone. The air moving toward the face had a reduced velocity and the dust line moved back to the end of the continuous mining machine. The high velocity air from the blower also tends to stir up more dust.

Wet Type Dust Collector Tried

When using an auxiliary fan exhaust system, fine coal dust is satisfactorily removed from the working place but is blown and carried across the section and settles in the return airways. Although not as proximate to sources of ignition as in a working place, it still presents a problem.

In an effort to solve this "float" dust problem—and the face ventilation problem as well—a water-injected dust collector was mounted on the continuous mining machine (figure 10). The cleansed air was discharged through 17-in. tubing to the crosscut. The unit was 54 in. long, 19 in. in diameter, and required a water rate of three to four gpm. Mounting was in the "throat" of the machine with the intake to the collector about eight ft from the face. A specially designed 20-hp motor was fitted into the fan housing and the

unit had a capacity of approximately 3500 cfm with 100 ft of tubing.

Elimination of "float" dust was excellent. However, the unit was not as effective removing dust from both the right and left corners of the face as it was throughout the central face region where the intake of the unit was located. This deficiency also applied to methane removal. This could be easily corrected by using a multiple intake system with an intake in each corner and one in the center.

Mounting the fan unit in the "throat" of the machine was not satisfactory. Insufficient clearance (four to six in.) between the fan unit and roof restricted maneuverability of the machine. Insufficient clearance between the fan unit and conveyor caused larger lumps of coal to damage the tubing and parts of the fan unit. This problem would probably apply only to the bulky boring-type machine.

A serious problem was encountered when additional tubing was required because of face advance. The fan unit had to be shut down to install an additional section of tubing to the fan unit. This disruption of ventilation often caused methane build-up before the fan unit could be restarted. Sliding the tubing on some sort of suspension wire and adding tubing at the crosscut was considered but not tried. Addition of tubing also caused considerable congestion in the small area around a boring-type machine. This interfered with the operator's visibility and operation of the machine when suspended on his side of the heading.

In many of the working places, the relatively small volume (3500 cfm) circulated by the unit was insufficient for proper ventilation. Air circulation was also restricted by the accumulation of water, discharged into the air stream by the dust collector, in the swags of the tubing. Effective area of the tubing was reduced and, at times, the excessive water weight caused the supporting roof spads to pull loose.

However, there is distinct merit to this dust collecting unit—if properly applied. Now available is a complete unit, skid or rubber-tired mounted, consisting of a dust collector and reject water pump with a common drive motor. The solids-laden reject water (two to four gpm) can be pumped back to the face area and discharged either as spray water or into the mined coal. The unit is 6 ft long, 28 in. high and 3 ft wide. It weighs 1600 lb and has a rated capacity of 3500 cfm with 100 ft of 14-in. tubing Using this unit with a face ventilation system similar to the one shown in figure 11 would be satisfactory in working places with methane liberations of less than 35 cfm.

Hydraulic Fan Mounted on Machine

Shown in figure 11 is a combination system the company has been using for over a year and which has proven to be more efficient and effective than any other method of face ventilation. It is a system using both the good diluting and sweeping action of a blower fan and the dust control features of an exhaust fan.

Mounted on the continuous mining machine is a small 10½-in. hydraulically driven centrifugal fan which operates off the machine's hydraulic circuit. Dimensions of the fan housing are 20 in. high, 16 in. wide and 13 in. long—weighing only 100 lb. This fan delivers 1200 cfm free flow. Attached to the fan is about 14 ft of six-in. tubing which is extended to the front of the machine. Due to frictional losses, about 650 cfm is discharged at the end of the tubing with a velocity of 3250 fpm. Even though small in volume, this blast of air is sufficient to move the methane from the far corner into the larger volume of air circulated by the exhaust fan. Care must be taken to keep the end of the exhaust tubing inby the small blower fan; otherwise, eddy currents are set up which hinder proper air flow across the face.

Note the use of 14-in. tubing on the exhaust side. Smaller tubing is much easier to handle and takes up less space yet does not drastically reduce the volume of air. The tubing is made of a flameproof, neoprene impregnated and coated cotton duck stitched over a spring steel wire helix. Tubing sections are ten ft long when fully extended. With 100 ft of well installed 14-in. tubing, the fan circulates approximately 4000 cfm. Methane liberations up to 40 cfm can be safely and efficiently handled with this system.

For Greater Methane Liberations, Two Fans Are Used

For liberations of 40 to 80 cfm, two fans and two sets of tubing are used. In this case, one fan tubing is extended to the immediate face, but the other tubing is extended only to the area between the continuous mining machine and loading machine where stratification of methane occurs when the single exhaust fan is used beyond its ventilating capacity.

Some aid is given to the two auxiliary fans by erecting a short wing curtain in the crosscut (figure 12) so

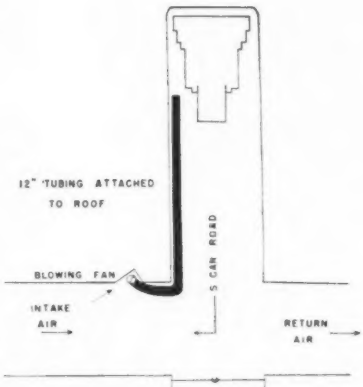


Fig. 7. Main objection to blower system was the heavy concentration of dust in the working area

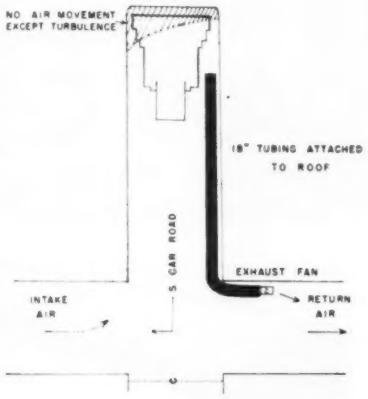


Fig. 8. An exhaust system using 18-in. tubing and a fan capable of producing 6700 cfm free flow. With 100 ft of tubing, approximately 5000 cfm was measured entering the tubing. With the end of the tubing seven to ten ft from the face, dust control in the face area was excellent, but the far corner would tend to gas up

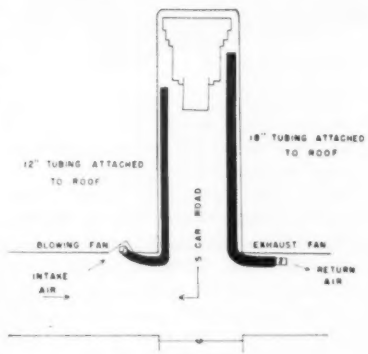
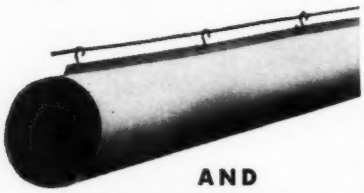


Fig. 9. A combination system using both the blower and the exhaust fan did an excellent job on methane liberations at the face. But, because only a portion of the total air moves up the heading (part through the tubing) at a relatively low velocity, stratification of methane occurs when fairly heavy liberations are encountered

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BRATTICE CLOTH CORP.

310 Argonne Road, Warsaw, Indiana

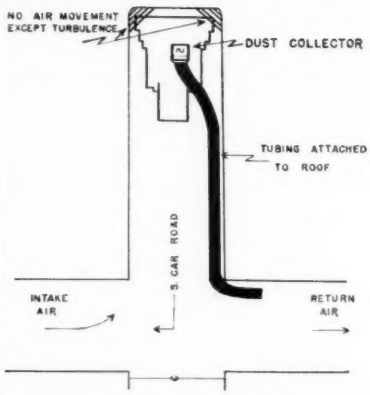


Fig. 10. A water-injected dust collector was mounted on the continuous mining machine and the cleansed air discharged through 17-in. tubing to the crosscut. Elimination of "float" dust was excellent. However, the unit was not as effective removing dust from both the right and left corners of the face as it was throughout the central face region where the intake of the unit was located. This deficiency also applied to methane removal. The situation could be easily corrected by using a multiple intake system with an intake in each corner and one in the center

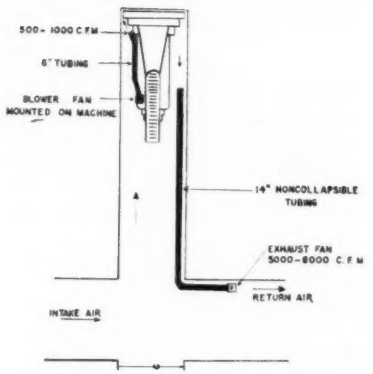


Fig. 11. A combination system using both the good diluting and sweeping action of a blower fan and the du control features of an exhaust fan. A small 10½-in. hydraulically driven centrifugal fan is mounted on the continuous mining machine and operated off the machine's hydraulic circuit. Attached to the fan is about 14 ft of 6-in. tubing which is extended to the front of the machine. About 650 cfm is discharged at the end of the tubing, a blast of air sufficient to move the methane from the far corner into the larger volume of air circulated by the exhaust fan

that the main air current tends to split in the working place instead of at the intersection. Part of the working place is then ventilated by the extra air forced in by the short line brattice.

When working places are encountered where methane liberations would be excessive if driven to the full 100 ft as projected (this occurs only in the two outside headings, No. 1 and No. 8, adjacent to virgin coal), the working place is stopped when ventilation capacity becomes inadequate. A short crosscut is then driven through from No. 2 to No. 1, or from No. 7 to No. 8, as shown in figure 3. These crosscuts are usually driven through on 50-ft centers which means that the continuous mining machine, when mining in No. 1 or No. 8 heading, need only advance a little over the machine's length beyond the crosscut rib line. With large volumes of air in the crosscut plus two auxiliary fans and a wing curtain, considerable methane can be safely handled while mining this short distance. After the two outside headings are advanced the full distance, liberations in the center headings are considerably lower and present no major problem when using auxiliary fans.

In conclusion, four important points should be emphasized:

1. Without proper face ventilation there is a constant threat of gas ignitions from sparks caused by cutting bits striking sulfur intrusions, pyritic lenses, etc.
2. Line brattice systems of ventilation are inefficient and cannot meet all the requirements of proper face ventilation.
3. Auxiliary fans and tubing, if properly used, offer a much more positive, efficient and reliable method of face ventilation.
4. The trend toward continuous mining is obvious. Each year increasing numbers of continuous mining machines are put into operation. This trend should induce more and more operators working in gaseous seams to consider the use of auxiliary fans in their mining plans.

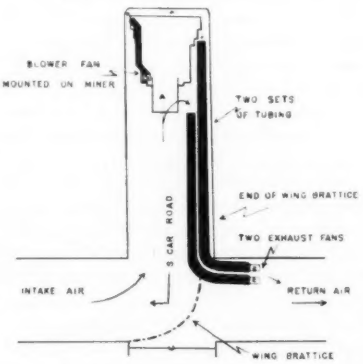
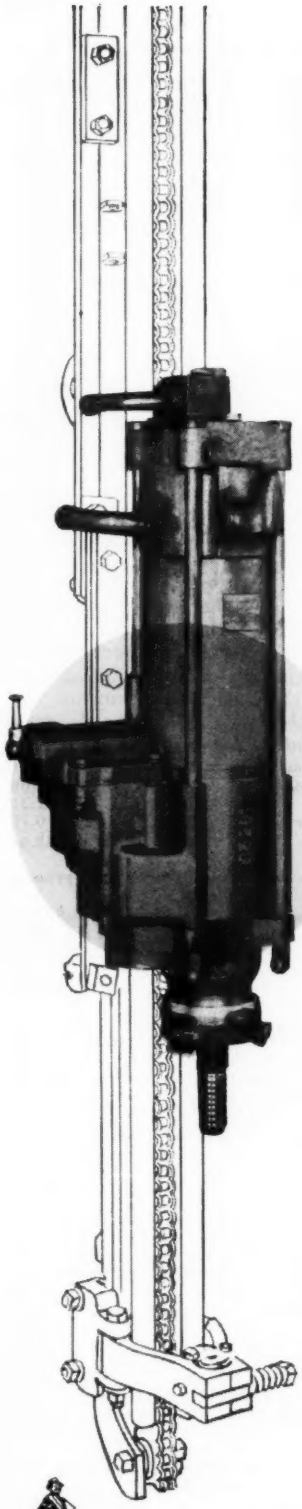
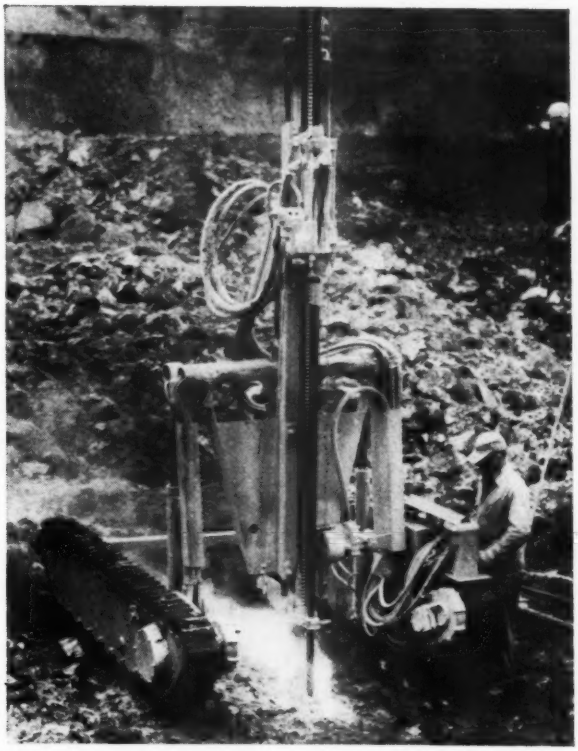


Fig. 12. Some aid is given to the two auxiliary fans by erecting a short wing curtain in the crosscut so that the main air current tends to split in the working place instead of at the intersection. Part of the working place is then ventilated by the extra air forced in by the short line brattice



The 450-DR is available on several self-propelled carriers, including the completely automatic TDM Trac-Drill shown at the right.



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The 450 DUAL Rotation Drill

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In competitive demonstrations of 4½" bore drills, the new Joy 450-DR not only drilled faster, but also finished blastholes which the conventional reverse rotation machines could not bottom.*

Dual Rotation, which made this superior performance possible, is provided by a powerful vane-type air motor geared to the chuck. It provides a booster to normal drilling rotation, and gives extra rotation power while actually reducing the strain on the rifle bar.

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BLASTING WET HOLES WITH AMMONIUM NITRATE

IN LIMESTONE—

Three operators describe how they use ammonium nitrate in wet holes for maximum yield and lowest cost

By

MARK F. WITHEY

Blasting Engineer
Material Service Corp.

FOR many years, ammonium nitrate has been used as an important ingredient in the manufacture of industrial dynamites. Ammonium nitrate alone remains quite stable in transit and in storage, without confinement, since it does not burn rapidly enough in air to cause an explosion.

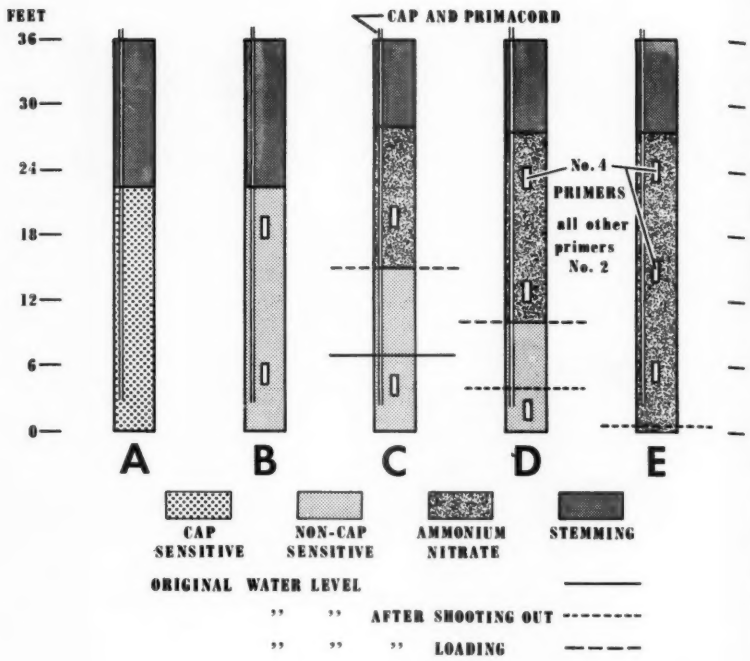


Table I

Cost Comparisons of Methods A through E

Method A: Hole loaded with standard cap sensitive explosive

225 lb cap sensitive explosive	$42.08
38 ft Primacord	1.21
1 electric blasting cap	0.15
Total	$43.44

Method B: Hole loaded with non-cap sensitive explosive and primers added

225 lb standard non-cap sensitive explosive	$37.13
38 ft Primacord	1.21
2 No. 2 primers	1.20
1 electric blasting cap	0.15
	$39.69

Method C: Hole loaded with non-cap sensitive explosive below water level, ammonium nitrate above water level. Loaded portion of hole extended 5½ ft by addition of 55 lb of ammonium nitrate

150 lb standard non-cap sensitive explosive	$24.75
130 lb ammonium nitrate	4.55
38 ft Primacord	1.21
2 No. 2 primers	1.20
1 electric blasting cap	0.15
1½ gal fuel oil	0.23
	$32.09

Method D: Hole loaded after water has been shot out and four ft of water has returned to the hole. Therefore, it is necessary to load 10 ft of non-cap sensitive explosive to rise above this four-ft level of water. Balance of hole loaded with ammonium nitrate.

100 lb non-cap sensitive explosive	$16.50
175 lb ammonium nitrate	6.13
38 ft Primacord	1.21
2 No. 2 primers	1.20
1 No. 4 primer	0.40
1 electric blasting cap	0.15
1 No. 2 primer, 1 No. 4 primer, 1 cap, and connecting wire to shoot out seven ft of water	1.35
	$26.94

Method E: Hole loaded with ammonium nitrate after water has been shot out. Only six in. of water has returned to hole

275 lb ammonium nitrate	$ 9.63
38 ft Primacord	1.21
1 No. 2 primer	0.60
2 No. 4 primers	0.80
1 electric blasting cap	0.15
2¾ gal fuel oil	0.41
1 No. 2 primer, 1 No. 4 primer, 1 cap, and connecting wire to shoot out seven ft of water	1.35
	$14.13

Just a few years ago, it was discovered that, when mixed with a suitable organic material or materials and confined, as in a borehole it could be detonated with a cap sensitive explosive and used as a blasting agent with certain limitations. Chemically, ammonium nitrate consists of five percent hydrogen, 35 percent nitrogen and 60 percent oxygen by weight. Only two-thirds of the oxygen is required for complete combustion of the compound, leaving one-third in excess. Suitable carbonaceous material, such as No. 2 diesel fuel, is added to the ammonium nitrate to utilize the excess oxygen and thereby produce maximum gas volume, resulting in maximum explosive force. Material Service Corp. uses approximately one gal fuel per 100 lb of nitrate.

The use of ammonium nitrate as a blasting agent has certain limitations. To date these limitations would appear to be restricted to use in larger bore holes only, say in diameters four in. and larger and in dry bore holes. The ready solubility of ammonium nitrate in water immediately limits its use under wet hole conditions to special applications and techniques. The remainder of this paper deals with techniques that have been developed at one of the company's limestone quarries which allow the use, under wet hole conditions, of maximum quantities of ammonium nitrate with satisfactory breakage of rock at reduced cost.

Excess Water Shot Out of Hole

At this quarry, normal practice is to drill a 5⅝-in. borehole to a depth of 36 ft which produces a 34-ft face of rock. The normal stand of water in the boreholes is seven ft although this measurement does vary over a range of one ft to 14 ft. Normal procedure is to shoot the water from these holes by lowering PETN into the borehole, with cap installed, by the connecting wires. The approximate quantity of PETN used is one lb per five ft water. All holes to be shot are prepared before any hole is shot and then the holes are shot individually. The column of water from a shot hole will rise to a height of 100 to 125 ft into the air.

Ammonium nitrate is then delivered to each blast hole in the estimated quantity required, oil is added and then the hole to be loaded is inspected for depth of new water made. If no more than six in. of water has returned to the hole, it is then loaded as indicated by the illustration and table I. If more than six in. of water has returned to the hole, cartridge powder is added in an amount sufficient to use above the displaced water and the remainder of the column is loaded as indicated.

The economics of the various applications of ammonium nitrate and other explosives involved, under the conditions set forth, are indicated in table I. It is a matter of simple arithmetic to determine the economics under other conditions of application.

At this quarry, in approximately 80 percent of the holes from which water is shot, the return water will not rise above six in. before the time when loading is started. In approximately 10 percent of the holes a column of water greater than one ft returns before loading starts, and in the remaining holes, the water column returns to its original level.

IN OVERBURDEN—

By

FRANK COULSON

Mine Manager
Central Ohio Coal Co.

THE Muskingum mine of the Central Ohio Coal Co. is located in Morgan County, Ohio, and is operating in the Ohio No. 9 or Meigs Creek seam of coal. The mine is operated in very rough terrain, resulting in a contour type of mining which is common in southeastern Ohio and in other areas where hills and valleys are prevalent.

The overburden to be removed by shooting varies from lime and clay shales with bands of limestone and sandstone ranging from two to five ft in thickness, which is considered normal cover, to massive sandrock ranging from ten to 40 ft in thickness. The surface cover consists of 20 to 40 ft of red clay and shales.

Eighty Percent of Holes Are Wet

An estimated 80 percent of all holes drilled contains water to some degree, caused either by water bearing strata or surface water drainage.

When shooting with a fixed explosive, water was no problem as explosives were used with waterproof wrappings. With the advent of ammonium nitrate as an explosive agent water became a problem, because ammonium nitrate readily absorbs moisture and thus becomes ineffective as an explosive. Bailing was tried as a means of water removal. This resulted in an uneconomical and an unsatisfactory operation as the water could never be completely removed.

The first problem to be overcome was the provision of suitable containers to protect the ammonium nitrate from moisture. After numerous experiments with metal containers and burlap bags of different construction, a decision was made to use an 11 by 39-in. A.M. size 10-oz burlap bag with folded side and bottom seam, and having a 12 by 43-in., two-mil polyethylene liner. The bags when filled are twisted at the top and clamped with a special wire tie. Operators have permitted holes to stand for forty-eight hours before shooting and still obtained satisfactory shots.

The second problem was obtaining a mixture of ammonium nitrate with the proper density to sink in water. The first experiments were made with clay coated prilled ammonium nitrate with sufficient sodium nitrate added to obtain the proper density. While the sodium nitrate provided the proper density it also desensitized the explosive agent which resulted in less effective shooting.

In order to improve the shooting an attempt was made to use only ammonium nitrate as an explosive agent. After a number of trial mixtures of prilled and crushed ammonium nitrate granules with no. 2 fuel oil to add carbonaceous material, the company has developed an explosive agent that has both the proper density to sink readily in water and sufficient sensitivity to provide good fragmentation of the shot material.

Two Mixes Are Used

Central Ohio uses a mixing machine to assure the proper mixing of the ingredients. At present two mixes are made.

(a) Mixture for dry holes:

This consists of prilled ammonium nitrate with a surface treatment to prevent caking and no. 2 diesel fuel oil. One batch for the machine amounts to 2000 lb of nitrate and 113.6 lb of no. 2 diesel fuel oil.

(b) Mixture for wet holes:

The mixture found satisfactory and now in use consists of:

1360 lb of prilled ammonium nitrate with a density of 0.95

640 lb of ground ammonium nitrate granules

85 lb of no. 2 diesel fuel oil

The bags are filled at the mixing plant by hand vibrating. By this method a 48-lb package with a density of 1.16 is obtained and it sinks readily in water.

The fuel oil–ammonium nitrate mixture has been tested with the Sliding Rod Fractional Impact Test and no action was obtained in ten finals at the highest drop of the sliding rod. In the straight five-kg drop weight test, where the oiled prilled nitrate mixture is struck by a steel plunger, the mixture again being placed on a steel anvil, no action was observed at a 50-cm drop. Above this height there is some action accompanied by the production of smoke.

Cast PETN Replaces Semi-Gelatin

The detonation of the nitrate mixture was formerly by the use of two by eight-in. sticks of 60 percent semi-gelatin fixed explosive. For the purpose of improving safety the detonating agent was changed to cast PETN.

In both cases 60-grain Primacord is used to discharge the detonators.

The prilled ammonium nitrate in dry holes and in the dry area, or upper section, of the wet holes is detonated by PETN at the ratio of one-third lb of PETN to 640 lb of ammonium nitrate. In water the ratio is one-third lb of cast PETN to 192 lb of nitrate. In water the cast PETN is placed in the bag and connected to the trunkline by a short section of Primacord, and in dry holes the nitrate is poured loose into the hole and the PETN is placed approximately in the center of the charge and connected in the same manner as above to the trunkline.

Since changing to PETN the results have been very satisfactory: good fragmentation, increased hole spacing, fewer drill holes and increased yield per pound of explosive.

IN TACONITE—

By

R. W. BELL

Mine Superintendent
Pickands Mather and Co.

Table I

1958 Blasting Agent Consumption

Property	AN Prill (lb)	%	Conventional Blasting Agents (lb)	%	Total Blasting Agents (lb)
Erie	1,660,000	28	4,308,000	72	5,968,000
Embarrass	46,000	19	194,000	81	240,000
Tioga	—	—	148,000	100	148,000
Danube	3,000	3	105,000	97	108,000
Mahoning	50,000	64	28,000	36	78,000
Scranton	30,000	62	18,000	38	48,000
Bennett	1,000	3	32,000	97	33,000
Mahnomen	—	—	4,000	100	4,000
	1,790,000	27	4,837,000	73	6,627,000

AMMONIUM nitrate and oil mixtures have been used as a blasting agent at the open pit iron mines operated by Pickands Mather & Co. in the Lake Superior District of Minnesota since 1956. Their use has increased steadily; in 1958 27 percent of the total amount of blasting agents consumed were ammonium nitrate prills.

A summary of the use of ammonium nitrate prills as compared to the conventional blasting agents at the various Pickands Mather properties is shown on table I.

The Erie taconite operation at Hoyt Lakes is the company's largest consumer of blasting agents. The following practice describes specifically the use of ammonium nitrate prills at this property.

All of the blast hole drilling in taconite ore is done by the jet piercing process; this results in a corrugated, rather than a smooth, cylindrical borehole. The diameter of the jet hole varies from a minimum of 6½ in. to a maximum of 13 in., which produces an average diameter of some nine in.

The taconite ore is a hard, flinty, ferruginous chert, criss-crossed with bedding and jointing planes which outline many large, pre-formed chunks. These chunks resist fragmentation. An indication of the hardness of this material can be shown by the fact that a 42T churn drill test produces only 12 ft of nine-in. hole per eight-hr shift, and averages only five ft per bit sharpening. The water conditions in the blast holes vary widely and are rather unpredictable.

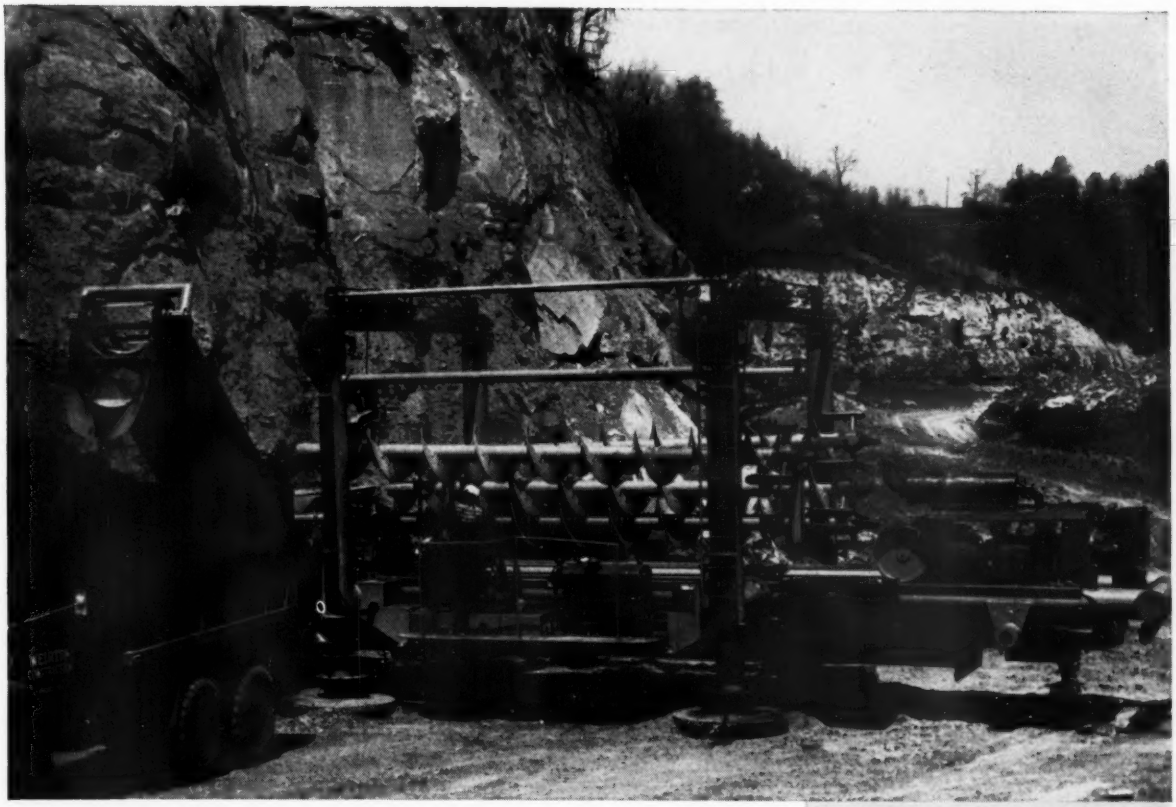
Blast Hole Loaded in Two Operations

Current practice is to load the typical blast hole in two operations. (See table II.) The first step follows shortly after drilling, and consists of placing a standard bottom load in the hole. This bottom load is composed of three, six-in. waterproof cartridges of blasting agent surrounded by 100 lb of prilled TNT, and topped by a 22½-lb primer. This combination of load provides a dependable bottom loading density of 40 lb per ft of hole. In instances where a heavier bottom load is required, the bottom five ft of the hole is chambered by the jet drill, and additional prilled TNT is used to bring it up to the top of the water-proof cartridges. This bottom load might stand several weeks before the top load is placed in the hole.

The second loading operation of the hole consists of placing in a top load just prior to blasting. The composition of the top load depends upon the water conditions in the hole. If the water table is high, or the hole is in a known water course, it is then loaded with a column of waterproof cartridges up to the desired stemming height, a second primer is placed near the top of the column and the hole is stemmed for blasting.

In relatively dry holes where the water table does not rise above the

(Continued on page 63)



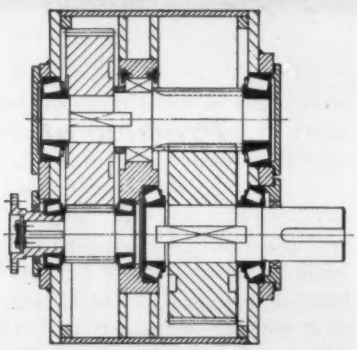
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THIS coal auger makes high hourly tonnage production from thin seams possible—and makes it pay. With a drilling depth of 150 ft., it drills within 4¾" of the bottom for maximum recovery. And to take the heavy thrust and shock loads, assure economical operation, Compton uses 6 Timken® tapered roller bearings in the main drive transmission, 6 in the power divider transmission, 4 in the auger spiders. Here are 2 big reasons why:

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Preview of

AMC MINING CONVENTION

Denver, Sept. 14-16
Trips, Sept. 17

The big AMC Mining Convention at Denver is less than a month away —Sept. 14–17 to be exact. This Convention is a most important occasion to the mining industry, and mining men and ladies from all over the country are planning to attend. Leaders in government will be on hand to express their views on national mineral policies, top-level mining officials will discuss the over-all state of the mineral industries, and highly qualified mining men will report on technical and operating progress in all phases of this great industry.

Final arrangements for the meeting have been made under the direction of Cris Dobbins, president of Ideal Cement Co. and chairman of AMC's Western Division. The following pages indicate the wide scope of the problems to be discussed and the good times in store for convention-goers.

A nation-wide program committee headed by E. I. Renouard, vice president, Western Operations, The Anaconda Co., has set up an outstanding program. Designed to include subjects with the widest range of interest



and application, it covers topics ranging from Government mineral policies, labor relations, taxation, public lands problems, uranium, and monetary policies to underground and open-pit mining, milling and metallurgy, research, safety viewpoints, management and general operating problems. Another feature which will attract wide attention will be a symposium on economic evaluations of proposed mining ventures.

The opening session on "What Are Our National Mineral Policies?" will feature the views of Administration and Congressional spokesmen, including Elmer F. Bennett, Under Secretary of the Interior; Thomas C. Mann, Assistant Secretary of State for Economic Affairs; J. Roy Price, assistant director, Office of Civil and Defense Mobilization; Thomas R. Rawlings, director, Barter & Stockpiling Division, Department of Agriculture; Senators James E. Murray of Montana and Gordon Allott of Colorado; and Reps. Wayne N. Aspinall of Colorado and Ed Edmondson of Oklahoma.

Headlining the Welcoming Luncheon Monday will be an address by Gov. Stephen L. R. McNichols of Colorado, with Denver's mayor, Richard Y. Batterton, extending the city's welcome to the Convention. Monday afternoon Senator Henry Dworshak of Idaho will preside at a session devoted to current conditions in the various branches of the mining industry, and suggestions as to Government policies will be presented by top industry men.

Two well-known Senators, John L. McClellan of Arkansas and Barry Goldwater of Arizona, will address a Tuesday morning meeting on the need for labor law revision. Both have gained national prominence in their fight for badly needed reform of laws governing labor - management relations and labor racketeering in general. Labor relations in the mineral industry will be discussed by Frank N. Price, industrial relations director of Ideal Cement Co.

At a tax panel that afternoon, two prominent members of the tax-writing Ways and Means Committee—Reps. Frank Ikard of Texas and Howard Baker of Tennessee—together with AMC Tax Counsel Ellsworth C. Alvord will discuss the impact of pending tax studies on the mining industry. Senator Thomas E. Martin of Iowa will preside. Immediately following will be a session on gold, silver and monetary policies; speakers will include Senator Francis Case of South Dakota, on the outlook for gold, and Senator Alan Bible of Nevada on the current silver situation.

Of particular interest to western mining men will be a Wednesday morning round-up on public lands problems, with Rep. J. Edgar Chenoweth of Colorado in the chair. Among those discussing the proposed wilder-

ness preservation system will be Rep. Al Ullman of Oregon. Frank A. Barrett, general counsel of the Agriculture Department, and George Abbott, solicitor of the Interior Department, will cover developments in government administration of laws dealing with multiple use of national forest and other public lands.

During a Wednesday session on uranium, Jesse C. Johnson, director of the Atomic Energy Commission's division of raw materials, will present the status and outlook for AEC's raw materials procurement program. Other speakers will cover the outlook for commercial use of uranium, nuclear explosions, and control of radiation in uranium mills.

Another special event will be an address on "What Research Can Do for the Mining Industry" by David C. Minton, Jr., vice president, Battelle Memorial Institute. He will speak at a Tuesday luncheon.

In addition, ten Convention sessions will present the latest developments in mining and metallurgical techniques, safety and management problems, etc. A "new approach" will be taken to the all-important problem of safety, with comments from all ranks of the industry, from the man at the face to the top executive—thus driving home the vital need for unremitting vigilance in accident prevention at all levels.

The many new factors entering into the evaluation of a proposed mining venture—which must be considered in addition to the classical concept of the "Hoskold formula" — will be brought out in a special symposium. Seven speakers will present the various aspects—including exploration and geology, mine development, processing development, mine and processing plant construction, and accounting, tax, and financial considerations.

The full program for the Convention sessions, all of which will be held at the Brown Palace and Cosmopolitan Hotels, is presented in the following pages.

DECLARATION OF POLICY

Under the chairmanship of Kenneth C. Kellar, chief counsel of Homestake Mining Co., the resolutions committee will draft a "Declaration of Policy," setting forth the mining industry's views on subjects of national importance, to be submitted for consideration by the Convention.

FUN AND RELAXATION

Aside from the important business aspects of the meeting many opportunities for convention-goers to enjoy themselves will be available. Always a hospitable state, Colorado this year is commemorating the 100th anniversary of the discovery of gold within its boundaries, with special events tuned to a "Rush to the Rockies" theme.

To further insure against any dull moments, Convention officials have arranged two noteworthy evening events. Monday a Miners Jamboree will be held at the world-famous Elitch Gardens; featured will be steak, entertainment and dancing as well as the Gardens' regular amusement facilities. The customary

(*Continued on page 57*)

WESTERN DIVISION
AMERICAN MINING CONGRESS

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W. G. MALONEY, Consultant, Mining Assn. of Montana.
D. L. MARLETT, Vice Pres., Great Lakes Carbon Corp.
PAUL A. MILLER, Gen. Mgr., Bald Mountain Mining Co.
EARL S. MOLLARD, Gen. Mgr., Hanna Nickel Smelting Co.
A. P. MORRIS, Gen. Mgr., Ray Mines Div., Kennecott Copper Corp.
ROBERT S. PALMER, Exec. Vice Pres., Colorado Mining Assn.
O. A. ROCKWELL, Vice Pres. and Gen. Mgr., Mining & Smelting Div., Eagle-Picher Co.
MILES P. ROMNEY, Mgr., Utah Mining Assn.
G. T. RUMMEL, Pres., LaSalle Mining Co.
MYRON L. SISSON, Supt., Sunrise Mine, Colorado Fuel & Iron Corp.
W. E. R. SMITH, Resident Mgr., Machovec Smelter, American Zinc Co. of Ill.
GLENN E. SORENSEN, Pres., The Kemmerer Coal Co.
CHARLES A. STEEN, Pres., Utex Exploration Co.
CLAUDE O. STEPHENS, Pres., Texas Gulf Sulphur Co.
A. J. TESKE, Secy., Idaho Mining Assn.
D. W. VILES, Vice Pres., Western Div., Vanadium Corp. of America.
S. H. WILLISTON, Exec. Vice Pres., Cordero Mining Co.
WALLACE G. WOOLF, Vice Pres., The Bunker Hill Co.

Arrangements

Committees



Cris Dobbins
General Chairman



Albert E. Seep
Vice Chairman
GENERAL COMMITTEE



Gerould A. Sabin
Chairman
PUBLICITY



Ben C. Essig
Chairman
WELCOMING



J. Price Briscoe
Chairman
TRIPS



Mrs. William T. Ahlborg
Chairman
LADIES

LADIES COMMITTEE ADVISORY BOARD



Mrs. Frank Coolbaugh



Mrs. Howard Crandell



Mrs. Ben C. Essig



Mrs. Albert E. Seep



Mrs. Merrill E. Shoup

Mrs. Cris Dobbins
(Photo not available)

Program Committee



E. I. Renouard
National Chairman
Program Committee



Charles Johnston
Alaska



B. R. Coil
Arizona



D. L. Marlett
California



A. M. Mastrovich
Colorado



Wallace G. Woolf
Idaho



F. E. Burnet
Montana



John C. MacDonald
Nevada



Langan W. Swent
New Mexico



Hollis N. Dole
Oregon



Paul A. Miller
South Dakota



Oscar A. Glaeser
Utah



Drury A. Pifer
Washington



A. V. Quine
Wyoming



O. A. Rockwell
Tri-State



E. L. Joppa
Lake Superior



H. Ripley Schemm
Central States



Z. W. Bartlett
Southern States



F. A. McGonigle
Eastern States



W. L. Wearly
Manufacturers

Convention Program

MONDAY SEPTEMBER 14

9:45 A.M. NATIONAL MINERAL POLICIES

8:30 A.M. Registration
Mezzanine, Brown Palace
Lobby, Cosmopolitan

Chairman: RAYMOND E. SALVATI, *President*, American Mining Congress

Invocation: DR. WILLIAM S. LEA, *Dean*, St. John's Episcopal Cathedral

What Are Our National Mineral Policies?

HON. ELMER F. BENNETT, *Under Secretary of the Interior*

J. ROY PRICE, *Assistant Director, Resources & Production*, Office of Civil & Defense Mobilization

HON. THOMAS C. MANN, *Assistant Secretary of State for Economic Affairs*

THOMAS R. RAWLINGS, *Director, Barter & Stockpiling Division*, U. S. Department of Agriculture

HON. JAMES E. MURRAY, *U. S. Senator from Montana;* Chairman, Senate Interior & Insular Affairs Committee

HON. GORDON ALLOTT, *U. S. Senator from Colorado*

HON. WAYNE N. ASPINALL, *U. S. Representative from Colorado;* Chairman, House Interior & Insular Affairs Committee

HON. ED. EDMONDSON, *U. S. Representative from Oklahoma*

Resolutions Committee Reports

General Policy
National Mineral Policies
Solid Fuels

12:15 P.M. WELCOMING LUNCHEON

Lincoln Room, Shirley-Savoy

Presiding: CRIS DOBBINS, *Pres.*, Ideal Cement Co., Denver; Chairman, Western Division, American Mining Congress

Presentation of Colors

ROSCOE HILL JUNIOR HIGH SCHOOL TROOP 54, Boy Scouts of America

Welcome to Denver

HON. RICHARD Y. BATTERTON, *Mayor of Denver*

Responses (2–3 minutes each)

RAYMOND E. SALVATI, *Pres.*, Island Creek Coal Co., Huntington W. Va.; President, American Mining Congress

E. I. RENOUARD, *Vice Pres., Western Operations*, The Anaconda Company, Butte, Mont.; National Chairman, Program Committee

WILLIAM L. WEARLY, *Pres.*, Joy Manufacturing Co., Pittsburgh; Chairman, Manufacturers Division, American Mining Congress

JESSE F. CORE, *Vice Pres.-Operations-Coal*, U. S. Steel Corp., Pittsburgh; Chairman, Coal Division, American Mining Congress

Introduction of Distinguished Guests

Address: HON. STEPHEN L. R. MCNICHOLS, *Governor of Colorado*



STEPHEN L. R. McNICHOLS
Governor of Colorado



GORDON ALLOTT
Senator from Colorado



ALAN BIBLE
Senator from Nevada



FRANCIS CASE
Senator from South Dakota



HENRY DWORSHAK
Senator from Idaho



BARRY GOLDWATER
Senator from Arizona



THOMAS E. MARTIN
Senator from Iowa



JOHN L. McCLELLAN
Senator from Arkansas



JAMES E. MURRAY
Senator from Montana



WAYNE N. ASPINALL
Congressman from Colorado



HOWARD H. BAKER
Congressman from Tennessee



J. EDGAR CHENOWETH
Congressman from Colorado



ED EDMONDSON
Congressman from Oklahoma

MONDAY, September 14 (Continued)

2:00 P.M. STATE OF THE MINING INDUSTRIES

Chairman: Hon. Henry Dworshak, *U. S. Senator from Idaho*

Copper:—Jean Vuillequez, *Vice Pres.*, American Metal Climax, Inc., New York

Lead-Zinc—Charles E. Schwab, *Chairman*, Emergency Lead-Zinc Committee, Washington, D. C.

Iron Ore—Richard W. Whitney, *Vice Pres.*, Hanna Mining Co., Cleveland

Light Metals—D. A. Rhoades, *Pres.*, Kaiser Aluminum & Chemical Corp., Oakland, Calif.

Strategic Metals—C. Hyde Lewis, *Pres.*, New Idria Mining Co., Idria, Calif.

Coal—Walter F. Schulten, *Vice Pres.*, Consolidation Coal Co., Pittsburgh

Industrial Minerals—Felix B. Shay, *Vice Pres.*, Foote Mineral Co., Paoli, Pa.

Fluorspar—Clyde L. Flynn, Independent Domestic Flourspar Producers Assn., Elizabethtown, Ill.

Resolutions Committee Reports
Government Reorganization
Mine Financing

2:00 P.M. UNDERGROUND MINING

Chairman: Joseph C. Kieffer, *Mgr., Northwestern Mining Dept.*, American Smelting & Refining Co., Wallace, Idaho

Vice Chairman: A. A. Ruoho, *Dist Mgr.*, Phillips Petroleum Co., Grants, N. Mex.

Sinking Large Circular Underground Shaft at Climax
Wm. F. Distler, *Mine Supt.*, Climax Molybdenum Co., Climax, Colo.

Sinking a Small Concrete-Lined Shaft in Wyoming
Ken Nobs, *Dist. Supt.*, Hidden Splendor Mining Co., Riverton, Wyo.

Mine Mechanization in Eastern Tennessee Zinc Mines
Johnson Crawford, *Asst. Mgr. of Mines*, The New Jersey Zinc Co., Jefferson City, Tenn.

Mining Operations of Union Carbide Nuclear Co.
James R. Borden, *Mine Supt.*, Union Carbide Nuclear Co., Uravan, Colo.

A Review of Recent Idarado Activities
A. C. Hilander, *Gen. Supt.*, Idarado Mining Co., Ouray and Telluride, Colo.

2:00 MILLING AND METALLURGY

Chairman: Frank W. McQuiston, Jr., *Chief Metallurgist*, Newmont Mining Co., New York

Vice Chairman: Earl C. Herkenhoff, *Dir. of Metallurgical Research*, Utah Construction Co., Palo Alto, Calif.

Transportation of Concentrates in Pipelines at International Nickel's Creighton Concentrator
D. A. Fraser, *Asst. Mill Supt.*, International Nickel Co. of Canada, Ltd., Copper Cliff, Ontario

Production of High Purity Metals
P. C. Good, *Supervisory Chemist*, Albany Metallurgical Research Center, U. S. Bureau of Mines, Albany, Ore.

Automation at the Anaconda Mill
John R. Moore, *Asst. Gen. Supt.*, The Anaconda Co., Anaconda, Mont.

Application of the Krupp-Renn Process to North American Iron Ores
Max Kennard, *Vice Pres.*, Southwestern Engineering Co., Los Angeles

Trends in Iron Ore Beneficiation
Stephen E. Erickson, *Dir. of Beneficiation*, M. A. Hanna Co., Hibbing, Minn.

7:00 P.M. MINERS JAMBOREE
Elitch Gardens

TUESDAY SEPTEMBER 15

9:30 A.M. LABOR RELATIONS

Chairman: Kenneth C. Kellar, *Chief Counsel*, Homestake Mining Co., Lead, S. Dak.

An Address
Hon. John L. McClellan, *U. S. Senator from Arkansas;* Chairman, Senate Committee to Investigate Improper Activities in Labor-Management Relations

The Need for Labor Law Revision
Hon. Barry Goldwater, *U. S. Senator from Arizona*

Labor Relations in the Mineral Industry
Frank N. Price, *Dir., Industrial Relations*, Ideal Cement Co., Denver

Resolutions Committee Reports
Labor Relations and Labor Legislation
Mine Safety



FRANK IKARD
Congressman from Texas



AL ULMANN
Congressman from Oregon



ELMER F. BENNETT
Under Secretary of the Interior



THOMAS C. MANN
Assistant Secretary of State

9:30 A.M. ECONOMIC EVALUATION OF PROPOSED MINING VENTURES—A Symposium

Chairman: E. H. CRABTREE, *Dir.*, Colorado School of Mines Research Foundation Inc., Golden, Colo.
Vice Chairman: RICHARD J. LUND, *Asst. Technical Dir.*, Battelle Memorial Institute, Columbus, Ohio
Introductory Remarks
FRED L. SMITH, *Mgr., Mining Div.*, Colorado School of Mines Research Foundation, Inc., Golden, Colo.
Exploration, Geology and Ore Reserves
EVAN JUST, *Head, Dept. of Mineral Engineering*, School of Mineral Sciences, Stanford University, Stanford, Calif.
Mine Development and Mine Operating Costs
JOHN W. CHANDLER, *Mining Engr.*, American Metal Climax, Inc., New York
Processing Development and Operating Costs
JOHN RIDDLE, *Metallurgical Engr.*, Union Carbide Nuclear Co., New York
Mine Plant and Processing Plant Construction
WILBUR JURDEN, *Pres.*, Anaconda-Jurden Associates, New York
Financial Projections to Determine Economic Feasibility
A. BRUCE MATTHEWS, *Managing Partner*, Arthur Anderson & Co., Denver
The Commercial Banker's Function in Financing Mining Ventures
THOMAS F. CREAMER, *Vice Pres.*, First National City Bank, New York

9:30 A.M. MILLING AND METALLURGY

Chairman: HARVEY MATHEWS, *Vice Pres.*, Stearns Roger Manufacturing Co., Denver
Vice Chairman: NORMAN WEISS, *Milling Engr.*, American Smelting & Refining Co., Salt Lake City
Some Applications of Radioactive Isotopes in Metallurgical Research
H. L. GIBBS and A. M. POSTON, U. S. Bureau of Mines, Salt Lake City
X-Ray Analytical Methods in Process Control at Anaconda
FRANCIS L. HOLDERREED, *Dir. of Metallurgical Research*, The Anaconda Co., Anaconda, Mont.
Flotation of Some Oxidized and Nonmetallic Ores
WILLIAM C. AITKENHEAD, *Dir.*, and JOHN A. JAEKEL, *Associate Metallurgist, Mining Experiment Station*, Washington State University, Pullman, Wash.
The Leach-Precipitation-Float Process at Kennecott's Ray Concentrator
ARTHUR W. LAST, *Chief, Ore Dressing Section*, Kennecott Research Center, Salt Lake City
Performance of the Kermac Solvent Extraction Plant in the Ambrosia Lake District
WAYNE C. HAZEN, *Senior Research Engr.*, Kerr-McGee Oil Industries, Denver

12:15 P.M. RESEARCH LUNCHEON
Lincoln Room, Shirley-Savoy

Presiding: JOHN D. BRADLEY, *Pres.*, The Bunker Hill Company, San Francisco
Address: What Research Can Do for the Mining Industry
DAVID C. MINTON, JR., *Vice Pres.*, Battelle Memorial Institute, Columbus, Ohio

2:00 P.M. TAX PANEL

Chairman: HON. THOS. E. MARTIN, *U. S. Senator from Iowa*
Proposals to Broaden the Tax Base
HON. FRANK IKARD, *U. S. Representative from Texas*
HON HOWARD H. BAKER, *U. S. Representative from Tennessee*
ELLSWORTH C. ALVORD, Alvord & Alvord, Washington, D. C.; A.M.C. Tax Counsel
Resolutions Committee Report
Taxation and Government Expenditures

3:15 P.M. GOLD, SILVER AND MONETARY POLICIES

Co-Chairmen:
DONALD H. MCLAUGHLIN, *Pres.*, Homestake Mining Co., San Francisco; Chairman, A.M.C. Gold Producers Committee
JOHN EDGAR, *Gen. Mgr., Mining Div.*, Sunshine Mining Co., Spokane
The Outlook for Gold
HON. FRANCIS CASE, *U. S. Senator from South Dakota*
The Silver Situation
HON. ALAN BIBLE, *U. S. Senator from Nevada*
Silver—The Metal with a Future
CLARK L. WILSON, *Vice Pres.*, New Park Mining Co., Salt Lake City
Resolutions Committee Report
Gold, Silver and Monetary Policies



J. ROY PRICE
Asst. Dir., Office of Civil & Defense Mobilization



GEORGE ABBOTT
Solicitor, Department of the Interior



FRANK A. BARRETT
General Counsel Department of Agriculture



JESSE C. JOHNSON
Director of Raw Materials Atomic Energy Commission

TUESDAY, September 15 (Continued)

2:00 P.M. UNDERGROUND MINING

Chairman: EUGENE P. REED, *Mgr. of Raw Materials*, Tennessee Coal & Iron Division, U. S. Steel Corp., Fairfield, Ala.

Vice Chairman: CLAUDE O. DALE, *Asst. Gen. Mgr., Mining & Smelting Div.*, Eagle-Picher Co., Miami, Okla.

Application of Principles of Rock Mechanics to Mine Planning
JOHN S. RINEHART, *Prof. of Mining Eng. and Dir. of Mining Research Laboratory*, Colorado School of Mines, Golden, Colo.

Mining Practices in Foreign Countries
EDWARD P. LEACH, *Gen. Mgr., Mining Div.*, Bethlehem Steel Co., Bethlehem, Pa.

Modernization of Gypsum Operations, Universal Atlas Cement Div., U. S. Steel Corp.
ROBERT B. JORDAN, *Chief Engr.*, Universal Atlas Cement Division, U. S. Steel Corp., New York

Roof Support Problems in Heavy Ground—A Panel Discussion

Applications of Hydraulic Fill
JOHN M. SUTTIE, *Mine Supt.*, The Anaconda Co., Butte, Mont.

Placement and Use of Concrete Underground
CHARLES L. PILLAR, *Mine Supt.*, San Manuel Copper Corp., San Manuel, Ariz.

Roof Bolting in Heavy Ground
CLARENCE N. KRAVIG, *Mine Supt.*, Homestake Mining Co., Lead, S. Dak.

Yieldable Arches
WILLIAM H. LOVE, *Gen. Mgr.*, Hecla Mining Co., Wallace, Idaho.

2:00 P.M. OPEN PIT MINING

Chairman: GLOYD M. WILES, *Mgr., Mining Dept.*, National Lead Co., New York

Ideal's 5½-Mile Overland Belt Conveyor Installation
GEORGE WILEY, *Chief Engr.*, Ideal Cement Co., Denver

Control of Air Blasts Effect Resulting from Blasting Operations
J. R. KRINGEL, *Vice Pres.-Production*, New York Trap Rock Corp., West Nyack, N. Y.

Skip Hoisting at Kennecott's Nevada Mines Division
FRANK QUILICI, *Pit Supt., Nevada Mines Div.*, Kennecott Copper Corp., Ruth, Nev.

Freeport's Nickel Cobalt Project at Moa Bay, Cuba
FORBES K. WILSON, *Vice Pres.*, Freeport Sulphur Co., New York

TUESDAY EVENING
Open—No Scheduled Entertainment

WEDNESDAY
SEPTEMBER 16

9:30 A.M. PUBLIC LANDS PROBLEMS

Chairman: HON. J. EDGAR CHENOWETH, *U. S. Representative from Colorado*

The Proposed Wilderness Preservation System
W. D. HAGENSTEIN, *Exec. Vice Pres.*, Industrial Forestry Assn., Portland, Ore.
W. HOWARD GRAY, *Attorney*, Reno, Nev.; Chairman, A.M.C. Public Lands Committee
HON. AL ULLMAN, *U. S. Representative from Oregon*

Administration of Public Laws 167 and 585
HON. FRANK A. BARRETT, *General Counsel*, U. S. Department of Agriculture
HON. GEORGE ABBOTT, *Solicitor*, U. S. Department of Interior

Resolutions Committee Reports
Public Land Policy
Water and Air Pollution

9:30 A.M. OPEN PIT MINING

Chairman: ALFRED T. BARR, *Mgr., New Cornelia Branch*, Phelps Dodge Corp., Ajo, Ariz.

Vice Chairman: JOHN D. BOENTJE, JR., *Vice Pres. & Gen. Mgr.*, Pacific Isle Mining Co., Hibbing, Minn.

Slope Stabilization in Open Pit Mining
STANLEY D. WILSON, Shannon & Wilson Engineers, Seattle, Wash.

The Bucket Wheel Excavator and Belt Conveyor—Germany's Solution to Low Cost Dirt Moving
ROBERT E. KENDALL, *Asst. Mine Supt.*, U. S. Borax & Chemical Corp., Boron, Calif.

Western Phosphate Mining
O. E. POTHIER, *Dir. of Mining Operations*, J. R. Simplot Co., Pocatello, Idaho.

Ammonium Nitrate Explosives
MELVIN A. COOK, *Prof. of Metallurgy and Dir. of Inst. of Metals and Explosives Research*, University of Utah, Salt Lake City

Large Truck Haulage at Eagle Mountain
MARTIN J. HUGHES, *Mgr., Eagle Mountain Mine*, Kaiser Steel Corp., Eagle Mountain, Calif.



THOMAS RAWLINGS
Director
Barter & Stockpiling Div.
Dept. of Agriculture



RICHARD Y. BATTERTON
Mayor of Denver

9:30 A.M. VIEWPOINTS ON SAFETY

Chairman: FRANK COOLBAUGH, *Pres.* Climax Molybdenum Co., Div. of American Metal Climax, Inc., New York

What Safety Means to the Miner
JOHN PERKOVICH, Homestake Mining Co., Lead, S. Dak.

Getting Proper Attitudes to the Working Face
DONALD E. WILSON, *Div. Mine Foreman*, Bunker Hill Mine, The Bunker Hill Co., Kellogg, Idaho

Administering a Safety Program
ROBERT A. WHITE, *Safety Supervisor*, Southwest Potash Co., Carlsbad, N. Mex.

Production and Safety
R. L. WAHL, JR., *Asst. Mine Supt.*, Colorado Fuel & Iron Corp., Sunrise, Wyo.

Responsibility of the Management Staff
H. D. STOTT, *Dir. of Industrial & Public Relations*, Calumet Div., Calumet & Hecla, Inc., Calumet, Mich.

The Top Executive's Role
C. D. MICHAELSON, *Gen. Mgr., Western Operations*, Kennecott Copper Corp., Salt Lake City

2:00 P.M. MANAGEMENT PROBLEMS

Chairman: E. I. RENOUARD, *Vice Pres., Western Operations*, The Anaconda Co., Butte, Mont.

Vice Chairman: PETER B. NALLE, *Supt. of Mining*, Riverside Cement Co., Riverside, Calif.

Application of Industrial Engineering Principles in Mining
MORLEY H. MATHEWSON, *Dir. of Ind. Engineering*, International Minerals & Chemical Corp., Skokie, Ill.

Application of Basic Standards and Standard Costs in Iron Ore Mining
G. T. BETHUNE, *Asst. Comptroller*, Oliver Iron Mining Division, U. S. Steel Corp., Duluth, Minn.

Economics of Equipment Replacement in the Mining Industry
F. G. KUEHL, *Vice Pres. of Operations*, International Talc Co., Gouverneur, N. Y.

Foreman and Supervisory Training
JAMES P. LOGAN, *Exec. Vice Pres.*, Mountain States Employers Council, Inc., Denver

Education of the Mining Engineer
WALFRID BEEN, *Head, Department of Mining Engineering*, Mich. College of Mining and Tech., Houghton, Mich.

2:00 P.M. URANIUM

Chairman: DEAN A. MCGEE, *Pres.*, Kerr-McGee Oil Industries, Inc., Oklahoma City

Vice Chairman: ALBERT V. QUINE, *Gen. Mgr.*, Lucky Mc Uranium Corp., Riverton, Wyo.

Current Status and Outlook for AEC Raw Materials Procurement Program
JESSE C. JOHNSON, *Dir., Div. of Raw Materials*, Atomic Energy Commission

The Outlook for Commercial Use of Uranium
NORMAN A. SPECTOR, *Pres.*, Vitro International, A Division of Vitro Corp. of America, New York

Peaceful Uses of Nuclear Explosions
SAMUEL G. LASKY, *Staff Assistant for Minerals*, Office of the Secretary of the Interior

Procedures and Precautions in Setting Off Large Nuclear Blasts
CHARLES E. VIOLET, Lawrence Radiation Laboratory, Livermore, Calif.

Measuring and Controlling Radiation in Uranium Mills
RALPH E. MUSGROVE, *Chief Metallurgist*, Climax Uranium Co., Grand Junction, Colo.

Resolutions Committee Report
Uranium

2:00 P.M. GENERAL OPERATING PROBLEMS

Chairman: R. R. WILLIAMS, JR., *Mgr. of Mines*, Colorado Fuel & Iron Corp., Pueblo, Colo.

Vice Chairman: CLYDE D. KEITH, *Supervisor of New Development*, Pickands Mather & Co., Duluth, Minn.

Special Steels for Special Mining Jobs
H. J. BENECKI, *Staff Metallurgist*, Crucible Steel Co. of America, Pittsburgh

Panel on Two-Way Radio Communications in the Mining Industry
EDWARD F. EIDMAN, *Asst. to Gen. Mgr., Mechanical*, Pacific Isle Mining Co., Hibbing, Minn.
DOUGLAS R. MABEY, *Contract Engr.*, Utah Copper Div., Kennecott Copper Corp., Salt Lake City
EDWARD J. MATOUSEK, *Mgr. of Gen. Eng.*, International Minerals and Chemical Corp., Skokie, Ill.
R. V. BOVENIZER, *Chief Elec. Engr.*, Hanna Coal Co., Cadiz, Ohio

Resolutions Committee Report
Mining Radio Service

7:00 P.M. "SPEECHLESS" BANQUET
City Auditorium

Toastmaster—HON. ALAN BIBLE, *U. S. Senator from Nevada*
Introduction of Distinguished Guests
Special Entertainment—Auditorium Theatre

THURSDAY SEPTEMBER 17

9:30 A.M. to 4:30 P.M. TAX FORUM
Century Room, Cosmopolitan

Chairman: LINCOLN ARNOLD, Chairman, Tax Committee, American Mining Congress

Discussion of current tax problems of the mining industry—for accountants and others handling tax matters and all interested mining men.

DIRECTORS

American Mining Congress



RAYMOND E. SALVATI
President



HORACE M. ALBRIGHT



LOUIS S. CATES



GEORGE J. CLARK



CHARLES R. COX



RUDOLPH T. ELSTAD



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MERL C. KELCE



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F. S. MULOCK



FRANK NUGENT



CHARLES J. POTTER



L. J. RANDALL



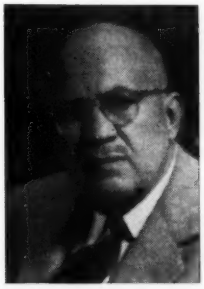
H. A. SAWYER



ELLERY SEDGEWICK, JR.



ALBERT E. SEEP



MERRILL E. SHOUP



HARRIE S. TAYLOR



L. NEWTON THOMAS



WILLIAM L. WEARLY



CLYDE E. WEED



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WILLIAM L. WEARLY

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D

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Differential Steel Car Co.
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E

Easton Car & Construction Co.
*Edison Industries, Thomas A.
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Electric Steel Foundry Co.
Electric Storage Battery Co.
*Elreco Corp.
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Equipment Engineers, Inc.
Euclid Division, General Motors Corp.

F

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Firth Sterling, Inc.
Fletcher & Co., J. H.
Flexible Steel Lacing Co.
Flexible Tubing Corp.
Flood City Brass & Electric Co.

G

Gardner-Denver Co.
*General Electric Co.
*Goodman Mfg. Co.
Goodrich Co., B. F.
Goodyear Tire & Rubber Co., Inc.
Gorman-Rupp Co.
Gould-National Batteries, Inc.
Gundlach Machine Co., T. J.—Div. of
J. M. J. Industries, Inc.
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*Hendrick Mfg. Co.
Hendrix Mfg. Co., Inc.
*Hercules Powder Co.
Hewitt-Robins Incorporated
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Hoyt Wire Cloth Co.
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I

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J

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Johnson-March Corp.
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K

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Kennametal Inc.
Kensington Steel Div., of Poor & Co.
Koehler Mfg. Co.

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Westinghouse Air Brake Co.
*Leschen Wire Rope Division
H. K. Porter Co., Inc.
LeTourneau-Westinghouse Co.
*Link-Belt Co.
Long Co., The
Longyear Co., E. J.
Ludlow-Saylor Wire Cloth Co.

M

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Macwhyte Company
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Marion Power Shovel Co.
Marion Power Shovel Co., a Div. of Universal Marion Corp.
*McGraw-Hill Publishing Co.
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Mechanization, Inc.
Meckum Engineering, Inc.
Metallurgical Products Dept. of General Electric Co.
*Mine Safety Appliances Co.
Mine & Smelter Supply Co.
Mining Machine Parts, Inc.
Monsanto Chemical Co.
Mosebach Electric & Supply Co.
Murphy Diesel Co.
*Myers-Whaley Co., Inc.

N

Nachod & United States Signal Co.
National Electric Coil Co.
National Malleable & Steel Castings Co.
National Mine Service Co.
Nolan Co.
Nordberg Mfg. Co.
Northwest Engineering Co.

O

Odgers Drilling, Inc.
*Ohio Brass Co.
Ohio Carbon Co
Okonite Co., The
Olin Mathieson Chemical Corp.
Oliver Corp., The
Orban Co. Inc., Kurt
Oshkosh Motor Truck, Inc.

P

Pattin Mfg. Co.
Penn Machine Co.
Peterson Filters & Engineering Co.
Pioneer Engineering Div., of Poor & Co.
Plastic Wire & Cable Corp.
Post-Glover Electric Co.
Productive Equipment Corp.
Prox Co., Inc., Frank

R

Raybestos-Manhattan, Inc.
Reich Bros. Mfg. Co.
Reliance Electric & Engineering Co.
Republic Rubber Division Lee Rubber & Tire Corp.
*Roberts & Schaefer Co.
Rock Products
*Roebling's Sons Corp., John A.
Rome Cable Corp.

S

*S K F Industries, Inc.
Salem Tool Co.
Sanford-Day Iron Works, Inc.
Schroeder Brothers
Screw & Bolt Corporation of America
Sheffield Division, Armco Steel Corp.
Sika Chemical Corp.
*Simplex Wire & Cable Co.
Simplicity Engineering Co.
Southwestern Engineering Co.
Sprague & Henwood, Inc.
Stearns Magnetic Products, a Div. of Indiana Steel Products Co.
Stearns-Roger Mfg. Co.
Sun Oil Co.

T

Tamping Bag Co., Division of Pickard Industries, Inc.
Texas Co.
Thermoid Division, of H. K. Porter Co., Inc.
Thor Power Tool Co.
*Timken Roller Bearing Co.
Tool Steel Gear & Pinion Co.
Tracy Co., Bertrand P.
Traylor Engineering & Mfg. Co.
Twin Disc Clutch Co.
*Tyler Co., The W. S.

U

Union Iron Works
Union Wire Rope Corp., Subsidiary of Armco Steel Corp.
U. S. Rubber Co.
*U. S. Steel Corp.

V

Varel Mfg. Co.
Vascoloy-Ramet Corp.
Victaulic Co. of America
Vulcan Iron Works

W

Wedge Wire Corp.
Western Contracting Corp.
Western Machinery Co.
Western Precipitation Corp.
Western Rock Bit Mfg. Co.
*Westinghouse Electric Corp.
White Motor Co., Autocar Division
Winter Weiss Co.
Wire Rope Corp. of America

AMC MINING CONVENTION

(*Continued from page 46*)

"Speechless" Banquet will take place Wednesday in Denver's City Auditorium, with Senator Alan Bible as toastmaster—to be followed by a special variety show in the Auditorium Theatre and dancing at the Brown Palace Hotel.

LADIES HAVE THEIR OWN PROGRAM

The ladies, always cordially invited to attend all convention activities, have in addition a special program of their own. This includes a sightseeing trip by special D.&R.G.W. train Tuesday over the Continental Divide west of Denver, including panoramic views of some of the world's most breathtaking scenery, and luncheon at El Monte Lodge in Granby. Next day they will attend a luncheon in the Shirley-Savoy Hotel, where they will be treated to a preview of fall fashions by Neusteters of Denver. Coffee will be served each morning at Ladies' Headquarters on the mezzanine of the Brown Palace Hotel, beginning Sunday, Sept. 13.

TRIPS PLANNED

Four field trips, open to everyone, have been planned for Thursday, Sept. 17. They will include visits to mining and manufacturing operations and to the new U. S. Air Force Academy north of Colorado Springs. The Academy tour will include a Chuck Wagon luncheon at the Garden of the Gods, famous for its unique sandstone formations.

Those who join the trip to the Climax Molybdenum mine will take the man-trip underground to inspect the new circular shaft described in one of the Convention papers, followed by a tour of the surface plant.

Also planned is a low-level air tour of the Colorado Plateau and adjacent uranium areas, with lunch at Grants, New Mexico. An inspection of Anaconda's Bluewater uranium processing plant will be included.

Colorado Fuel & Iron Co. will make arrangements during the Convention for those who would like to visit the company's steel plant and seamless pipe mill at Pueblo.

MAKE RESERVATIONS NOW

No mining man who wants to keep abreast of the latest developments affecting his industry can afford to miss being in Denver the week of Sept. 19. Anyone who has not yet done so should make his hotel or motel reservation immediately. Requests for accommodations should be sent to the AMC Housing Bureau, care of Denver Convention and Visitors Bureau, 225 West Colfax Ave., Denver, Colo. Don't delay—do it today!



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UNDERGROUND
LOADING MACHINES"

The Roberts Tunnel

By
THEODORE F. ADAMS
Project Manager
Blue River Constructors

A project such as the $45,000,000 Roberts tunnel must represent the best in rock excavation methods. Mechanization, larger capacity equipment, and improved operating cycles are but a few of the important advances in tunneling practice which allow the contractor to come out ahead after the project is completed

THE Harold D. Roberts tunnel in Colorado is being driven for the City and County of Denver. It is a $45,000,000 project, about 23 miles long and will be 10-ft 3-in. in diam when concrete lined. The purpose of the tunnel is to supply water to the City by diversion from the western to the eastern slope of the Continental Divide. It is designed to carry 788 cfs and will help solve the water shortage created by an expanding population.

While tunneling is primarily an excavating cycle consisting of a sequence of operations, other criteria such as the type and condition of the ground being worked and the size and shape of the tunnel determine the rate of progress. In addition, overbreak beyond pay lines can be a major item, because it seriously affects the excavation cycle and concreting operations.

Improvements in all phases of tunnel operations have added to tunneling speed. Mechanization and higher capacity equipment have contributed. In any case, a constant effort is made to improve operating cycles.

The Roberts tunnel is being driven by a combine of six contractors called Blue River Constructors with Mid-Valley Utility Constructors as the sponsor. Tipton and Kalmbach of Denver are handling the design, engineering and inspection. The contract is on a unit price basis, and all phases come under the Board of Water Commissioners of the City of Denver.



For variable length rounds, which are drilled in rock where the daily advance may range from two to 85 ft, the flexibility of the pyramid cut has merit. The burn cut with large hole relief offers advantages in uniform material, but is not the best choice for rock that has many structural defects. Shown is a jumbo at one of the tunnel's headings

Tunnel Driven From Four Headings

The tunnel is at an altitude of about 8700 ft. It starts near the town of Dillon on the western slope and comes out near Grant on the eastern slope. It is being driven from four headings—one at each portal and two more from a shaft which is about 8.5 miles from the West Portal. The circular shaft is about 916 ft deep, 16-ft in diam and concrete lined.

One of the interesting aspects with regard to the tunnel is that, when it is completed, waters from the Upper Colorado River will be diverted toward the Atlantic Ocean instead of the Pacific. This tunnel will be one of the longest in the United States to be driven from three points. The Grant portal will run about 10 miles.

The topography and amount of time allowed for the completion of the tunnel determines the number of portals and shafts, and there is a direct relation between the cost of sinking and hoisting as compared to the long haul in the tunnel. Because the additional cost of running headings from a shaft is from five to ten percent higher than running from portals, and hoisting is about half as fast as haulage through a heading, the use of auxiliary shafts is not so economical as it was before present developments of drilling, blasting, mucking and hauling.

Another feature that has an overall bearing on tunnel driving speed is that the rate of progress is apt to be greater in long than in short tunnels.

As to actual facilities, there are good roads to all locations and it is a matter of trucking material and supplies from a central rail point which is Denver. Power is readily available at all locations although a power line was run 25 miles to supply the East Portal. Communication is an important item and there are direct dial telephone connections between the East and West portals through Denver. We are experimenting with a direct line from the tunnel heading at the West Portal to all other points. To date it has proven to be convenient and a time-saver in case of emergency.

The climate is typical of the higher altitudes with a short summer and rigorous winter; however, once all of the operations are underground weather is no problem.

As to labor and living conditions. there were enough skilled tunnel workers to form the nucleus of an organization that could train the unskilled workmen; however, there has been a turnover of labor on the west side due to the more difficult working conditions. Housing has been no problem, and company rented trailers and a bunkhouse provide sufficient facilities. Medical service is available at all points and an ambulance is stationed at each location for emergency cases.

Passes Through Complex Geology

The tunnel passes through some of the more complex geology of the Continental Divide. It consists of various sedimentary, metamorphic and igneous rocks. In addition to a major thrust fault that has a displacement of several miles and cuts the tunnel twice, there are numerous other fault systems including several mineralized zones. While no ore has been mined at this depth below the Continental Divide where the maximum cover will be 4400 ft, it is interesting, of course, to open up unexplored areas. Competent rock in itself presents no serious difficulties —it is rock deformation and the intensity that presents problems in tunnel driving. Add to this water and/or gas, and the problem is compounded. Regardless of how much study is devoted to a tunnel route, geologically speaking there are numerous exceptions to the general criteria. The degree of jointing, faulting, folding and intensity of the movements all have a differential bearing. Whether the rock is completely crushed, or unconsolidated and chemically disintegrated, affects the rate of progress. The tunnel is over 50 percent driven, and one of the pertinent facts appears to be that the class and intensity of the rock defects has a greater bearing on progress than type of rock. Geology has played an important part on this tunnel; primarily in determining the alignment to lessen the hazards. Even so, a number of hazards have been encountered and there will be more until the tunnel is holed-through.

Circular Shaft Sunk with Jumbo and Orange Peel

Excavating cycles are equally as applicable to shaft work as tunnel work. In sinking the shaft on this contract the Bain system was used, with variances in types of equipment. This cycle consisted primarily of drilling, shooting, mucking and repeating, then setting forms and concreting. Some of the criteria developed in sinking this shaft in hard rock were as follows:

1. An orange peel grapple appeared to be more adaptable for mucking than a clam shell bucket
2. A drill jumbo was a definite advantage, and for this size shaft four drills and jibs were sufficient
3. There is an advantage to having a battleship type slip form for concreting in that it does not have to be removed from the shaft between cycles
4. It was possible to completely use the entire area of the 16-ft shaft. This has been one objection to circular shafts in the past as compared to rectangular shafts
5. There are two hoisting systems —one for the muck skips and one for the counter-balanced cage. In case of a breakdown on the skips, muck cars can be hoisted on the cage
6. The shaft was sunk with a crane until a permanent headframe was erected. In certain cases this could be an advantage as the cost of a temporary headframe is eliminated
7. It would appear that a vertical labor union is more adaptable to shaft sinking than a horizontal union. Similar working conditions lead to greater efficiency in manpower

Costwise there is no strict rule of thumb for comparing the cost of a shaft to a tunnel of comparable size. But, with all the qualifications taken into consideration, one lineal ft of average shaft might cost as much as three ft of tunnel. Any costs are subject to local conditions of labor and supplies, and, to repeat, ground conditions are a deciding factor.

Drilling and Blasting in Tunnel Described

As to tunnel driving, methods are essentially the same at all four headings. Here again it is drill, shoot, muck, set supports (if necessary), and re-cycle. Rather than repeat some of the details which are common knowledge and which have been covered in many articles, it might be well to cover some of the many ideas that we have tried in the past few years. These various ideas are applicable primarily to this size tunnel.

In drilling the pyramid cut Blue River Constructors have stayed primarily with the 3½-in. drifter. However, the length of feed has varied. Originally the three-ft feed was used and up to a six ft feed has been tried. At three of the headings a four-ft feed is being used. On one heading a five ft feed is used. In using a longer feed, less changes of steel are required and a longer round can be drilled. Various types of alloyed drill steel have been tried; however, costwise, straight carbon drill steel still seems to be satisfactory and does not require any special handling in the drill sharpening shop.

Practically all makes of bits have been tried and just about the time it appears that one bit may have an edge, which can only be told by cost per ft of drilling, someone else will have an improved bit or price. Since the relation between the drill, steel and bit are dependent upon each other, a radical change of one component materially affects the other two. The present combination appears satisfactory for the time being.

There has been considerable comment on the burn cut with the large hole relief. There is no question that in uniform material, without rock defects such as exist in the Roberts tunnel, there are a number of advantages. But, the burn cut is not entirely the answer. For variable length rounds which are drilled in rock where the daily advance may range from two to 85 ft, the flexibility of the pyramid cut also has merit. The ground on the Roberts tunnel changes from round to round, from "popping" ground to mud. In order to be flexible enough to overcome most situations, the company has continued to use the pyramid cut.

In blasting a number of things have been tried. It has been found that longer sticks of powder help in loading time. By decreasing the diameter of a hole drilled to a minimum, greater explosive efficiency can be obtained. The advantages of short period caps are not clear. About one out of ten shots has been successful. There is a cannonading problem with short period delays. Since facilities such as air, water, power and ventilation are carried relatively close to the face, cannonading by these types of caps can completely sweep the heading clear for a distance of 100 or 200 ft. Perhaps a combination of regular and short-period delays might be the answer.

At this stage of the cycle ventilation is a governing factor. The alternate blow and exhausting method is used while shooting. A number of tunnels have been, and are being driven, with the air being exhausted continuously. There is one inherent problem with continuous exhausting, and that is temperature of the tunnel. Due to increasing cover, the temperature is gradually rising at a rate less than a degree per 100 ft of cover. Due to the velocity of the air through a pipe and its expansion upon discharge, the cooling effect of air blown into the face is noticeable. On continuous exhaust, however, that advantage is not realized and on weekends, when the air is exhausted continuously, the increase in temperature and humidity in the heading is quite noticeable. Nevertheless, exhausting does clear the tunnel of fog which seems inherent with this type of blow and exhaust.

Diesel Locomotives Cause Smog Problem

An overshot loader is used for mucking. For years in this size of tunnel, the only machine that actually fit was a medium sized loader. It was found that by minor alterations a larger size could be used and an increase in loading capacity obtained. This required larger cars and a step was made from a three-yd car to a five-yd car. This, in turn, required less switching and a decrease in loading time. The next step would be the use of a continuous loader that would operate economically in hard rock and a larger car, or cars (which have already been developed to a limited extent).



In hard rock portions of the tunnel, the ground must remain open for a considerable length of time prior to concreting. Roof bolts are used as a temporary means of support and guniting sometimes helps stabilize sections between roof bolts. Standard steel rib supports are being used, particularly in soft or squeezing ground

Considerable work has been done with diesel locomotives. Blue River Constructors started out using diesels but have gradually changed to a combination of diesel and battery. While reasons are not absolutely clear at the moment, a smog condition was encountered that persisted with the use of diesel locomotives. While fog is a common occurrence in a long tunnel at this altitude, smog is that much worse. In addition, the faster the locomotive moved, the more nitrous oxide was obtained. Nitrous oxide from both the powder and the diesels has been kept well below requirements, however. In conjunction with both the Federal and State Bureau of Mines a rather thorough check has been maintained on various gases.

It has been customary in this type of operation to use track of a weight and gage that would meet the most adverse conditions. Although tables indicate that 45-lb rail could be used, a 56-lb rail is more satisfactory because track maintenance is much less. The gage is 24 in. Equipment is normally twice the track gage; therefore it has been found that in this size tunnel, with all the pipe lines including pump lines, clearance is a problem. A regular railroad system of block signals operated by pull switches is in use.

Although the conventional type of steel rib supports are being used, roof bolting has become predominant in certain types of ground. In rock portions of the tunnel, due to the length of time the ground has to remain open before concreting, it has been necessary to go back and roof bolt those portions. In addition, guniting has helped stabilize those sections in between the roof bolts. However, to use roof bolts continuously and eliminate steel supports entirely is wrong and could be dangerous—particularly in soft and swelling or squeezing ground. The majority of accidents underground are caused by rock falls, which suggests that there is no absolute criterion as to the type of support that will proved complete safety.

The project is set up to handle 10,000 gpm from the shaft and 5000 gpm from each heading. Here again the problem of pump capacity presents itself. With the proper use of feeler holes and grouting it is possible to prevent any excess flows of water. In case of a sudden inflow, especially on a downhill heading, it is believed that sufficient capacity is

available to prevent a flooding condition.

The electrical system, while not novel, uses 4160 volts underground. This was brought about by transmission problems more than anything else. In addition, a dry-type transformer is being used underground. While over-capacity may be the consideration, unexpected power demands can be handled without a shortage of power.

Engineering, surveying and compliance with the specifications are a function of Tipton and Kalmbach. Blue River Constructors are responsible for driving and lining the tunnel and for related operations. More than 550 men are employed by the company for the excavation phase of the project. However, in addition to the manpower required for the tunnel which will average about 105 men per heading, including overhead personnel, a number of men are involved in sinking and lining the gate shaft at the intake end of the tunnel and the surge chamber at the discharge end. In addition, during the summer a gravel plant was installed to produce the aggregate necessary for lining the tunnel on the west side. Next summer it will be in operation on the east side. In addition to maintaining a yard in Denver for material and supplies, and rail deliveries, all trucking is handled by the company.

Competition Important Factor in Labor's Output

The AFL-CIO heavy construction unions are the principal labor organizations involved in tunnel work. Labor relations, of course, is one of the most important phases of the work, and in order to make a tunnel crew "click," so to speak, a sense of competition and loyalty must develop. It is not so much a question of footage, although footage is a standard commonly used—it is a question of all the ramifications involved to get the footage and line the tunnel afterwards.

As mentioned heretofore, there is a constant effort being made to improve schedules, advance and costs, and the successful tunnel contractor must, of necessity, not only learn from his own experience but be able to draw upon and use the ideas and experiences of others—whether they be tunnel contractors or those in the mining industry. Considerable progress has been made in the way of efficiency, but there is still room for even more improvements. Cutting a minute of a cycle eventually adds up to a major improvement. Mechanization and increase in size of equipment have all contributed to the above. From our own experience Blue River can drive a tunnel about 12 percent faster than it could eight years ago with about the same manpower, provided comparable conditions exist.

Due to the scope of the Roberts tunnel, there is an excellent opportunity to improve on present methods providing it does not interfere with required progress. Improvements are possible, not only in driving, but in concreting as well.

IN TACONITE

(*Continued from page 42*)

standard bottom load, 50-lb sacks of prilled amonium nitrate are poured into the hole up to a pre-determined stemming height, with a 5½-lb primer being placed near the top of the prill column. No. 2 fuel oil at the rate of one gal per 100 lb of prills is then metered into the hole from a conventional fuel oil delivery truck. The ammonium nitrate and oil mixture results in a column density of about 23 lb per ft of hole. The current practice of adding fuel oil in the hole has yielded a saving in time and labor over the previous practice of adding fuel oil to the individual sack of prills, and to date, the fragmentation has not suffered.

In holes where the water rises just slightly above the standard bottom load, sufficient waterproof cartridges are placed in the hole to reach above the water table. A small quantity of ammonium nitrate lumps is then poured into the hole to seal off the annular opening between the cartridges and the wall of the hole. The remaining part of the hole is loaded with ammonium nitrate prills in the same manner as if it were dry.

Continuous experiments are being carried out which will permit a still greater utilization of ammonium nitrate prills.

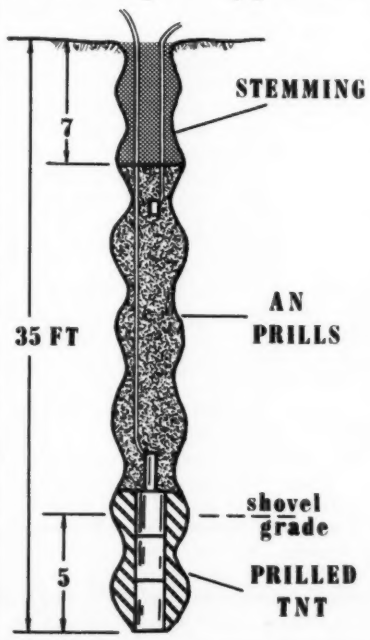
Big Shots Are the Rule

Currently, the typical taconite blast averages 300,000 long tons and involves some 230 holes loaded with 175,000 lb of blasting agent. This provides Erie with enough rock for about five days of production. It appears that a blast at least this large is required to minimize delays to a railroad operation producing over 60,000 long tons of rock a day with a relatively few number of working areas.

The fragmentation and results obtained from using ammonium nitrate prills have been highly satisfactory, and their use has been a major factor in cutting costs in Pickands Mather's open pit mining operations.

Table II

Loading A Typical Dry Blast Hole With Ammonium Nitrate



Depth	35 ft.
Hole Spacing	20 x 24 ft.
Subgrade	5 ft.
Stemming	7 ft.

LOADING DETAILS

3 6-in. cartridges	135	lb.
TNT	100	
1 primer	22½	
AN prills	500	
1 primer	5½	
Total	763	lb.

POWDER FACTOR

$\frac{763}{1309} = 0.58$ lb. per ton

$0.58 \times 2.45 = 1.45$ lb. per cu. yd.

Are A-C Sections PRACTICAL in a D-C Mine?

Adaptability of the existing underground power system . . . use of existing equipment . . . cost of a second underground transmission system . . . equipment maintenance costs . . . improved features of a-c power systems and equipment—all of these factors will govern any decision to install a-c sections in d-c mines

By

JAMES G. WILEY

Electrical Engineer
Rochester & Pittsburgh Coal Co.

THE practicability of using a-c equipment in an existing d-c mine is affected by various economic considerations. After looking at these items, one may be in a better position to make the correct decision on use of a-c equipment in a d-c operation.

Items to be considered are: adaptability of the existing underground power system; use of existing equipment; cost of a second underground transmission system; equipment maintenance costs, and the improved safety features of a-c power systems and equipment.

Existing System Considered

The first consideration is the existing underground power system. Is it an a-c or d-c system? If it is an underground a-c system, is it adequate for additional load and of a suitable voltage to prevent excess line regulation with 440-volt current face equipment? An underground a-c system must consist of a suitable power transformer, with a neutral grounding resistor; a circuit breaker with overcurrent and ground protection; a mine power cable consisting of three individually shielded phase leads with ground wires, or individually shielded conductors with provisions for monitoring ground wire continuity. The system voltage should be a minimum of 2300 in order to keep mainline transmission cable to a nominal size. Provisions for tapping the main high voltage cable is required, preferably a circuit breaker with a separate ground wire monitoring scheme for the branch circuit high voltage cable.

If the existing underground system is d-c, little can be done toward use of a-c equipment without the expensive installation of a complete a-c system. Because it is not practical to make a changeover to an a-c system, it may be more practical to extend surface high voltage lines to appropriate locations and drill a borehole to provide entrance for a high voltage system. In most cases where surface substations are employed, it would be more economical to extend the surface transmission system, rather than install an underground high voltage transmission system.

What Equipment Is Available?

The availability of existing d-c equipment may influence the use of d-c and a-c equipment on the same section. This is the arrangement that Rochester & Pittsburgh Coal Co. has at its mine in northern West Virginia. The main underground transmission system is 4160 volts, which the company had been burying on the bottom until recently. Permission was then secured to suspend the cable from the roof, so that now the mine is able to extend its main transmission system much cheaper and easier. On these combination sections, the boring-type mining machines use a-c, while all service equipment is operated on 250 volts d-c. The reason for having 250 volt d-c on the service equipment is that this is the only mine which the company operates on 250-volts d-c, and the equipment was in too good condition to scrap. The big problem on these sections is the time and material required to keep both a-c and d-c feed lines up to the face area. The d-c load is practically the same as it was with conventional d-c equipment, so that the mine must continue to keep a 1000 MCM feed line, and return, in the section.

It is felt that even with the problem of keeping both a-c and d-c feeders up to the face, it is still a better arrangement than having d-c boring-type continuous mining machines. It has been the company's experience with one d-c boring-type machine that, due to the concentrated load, it requires a minimum 200-kw motor-generator set exclusively for the continuous mining machine section with a separate feed line from the substation, and that the generator must be advanced frequently because of rapid development.

A-C Power Equipment Easier to Handle, Costs Less

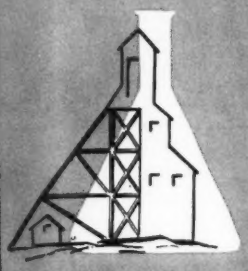
The ease of advancing a-c power equipment blends itself well with the trend to high tonnage machinery, with concentrated motor loading and rapid advancement. A-C power equipment is enclosed, skid-mounted and can be readily moved. Advancement of a-c power centers is much cheaper than having to move d-c conversion equipment, which normally requires a separate substation room, and in the case of rotary equipment, a good solid foundation. Labor required to move an underground power center

(*Continued on page 70*)

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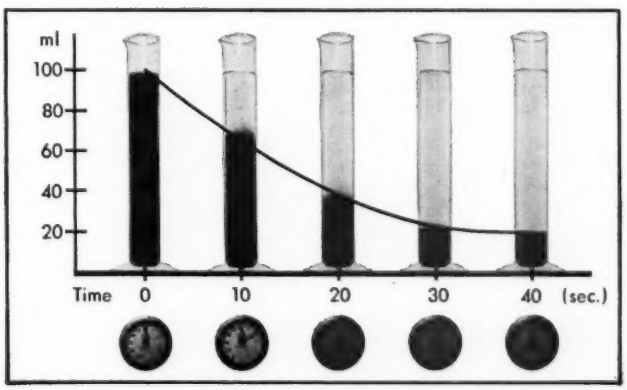
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Vice President and General Manager
E. J. Longyear Co.

IN considering the subject of exploration drilling, it is natural that we should be interested in recently developed tools, materials and techniques which are today or hold future promise to be of material benefit to those exploring for mineral deposits.

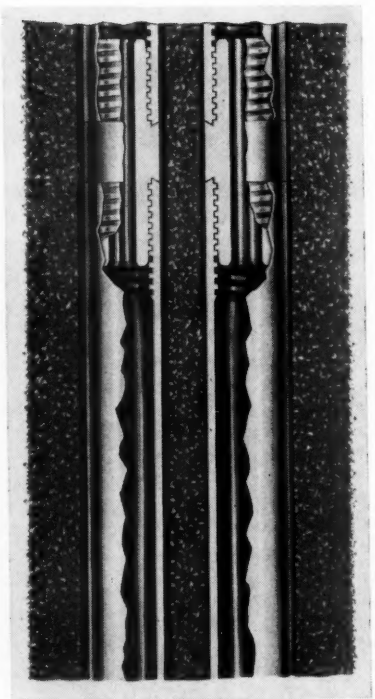


In view of the continuous rise in the cost of labor and material plus the necessity to produce dependable drill samples economically, the manufacturers and users of drilling equipment have together developed a number of new tools and techniques which are having an important effect on today's exploration drilling, both from the standpoint of time, cost and securing more representative samples.

Let us first briefly review some of the techniques, materials and equipment of recent vintage which appear to have been important in contributing to the improvement of exploration drilling.

Drill Hole Circulating Pumps

Many users of exploratory diamond core drilling equipment insist that one of the most important items of equipment used in core drilling is the pumping unit. The primary function of the pump in rotary drilling applications is to rapidly remove cuttings from the bottom of the hole, presenting a continuously clean surface to the bit, and to provide an adequate and continuous flow of the circulating fluid across the face of the bit which acts as a coolant and prolongs the life of the bit.



The difference between old standard drill rods and the "W" series rods is shown here. The "W" series rod (right) is larger in diameter and has a coupling of a larger internal diameter than the old standard rod (left). These differences give the "W" series several advantages: (1) the drill string is more stable in the hole, transmitting less vibration to the drill; (2) the smaller annulus between the rod and the wall of the hole increases velocity of discharge fluid, speeding removal of cuttings; and (3) an adequate supply of water is more easily pumped through the drill string, minimizing the burning of bits

With the introduction of the variable-volume, high-pressure, transmission-equipped piston pump and the closed-circuit circulating system, a substantial saving in diamond bit expense has been realized. Concurrently, the incidence of "stuck" drill strings has been reduced and core recovery has increased because the drill operator, with simple instrumentation, can detect a blocked bit or core barrel and thus prevent core grinding. The availibility of abrasion resistant ceramic liners and the ball valve assembly make it possible to effectively circulate drill mud.

Drill Hole Stabilization

In many poorly consolidated formations, drilling mud and/or flocculants have made it possible to economically drill and core material which otherwise would not have been possible except at an exorbitant cost. In many instances, it has been only through the use of drill hole stabilizing agents that the target has been reached. Materials commonly used for this purpose consist of bentonites and flocculants such as Aerofloc and Separan.

"W" Series Drill Rods

The "W" series drill rods were adopted as the standard by the Diamond Core Drill Manufacturers Association in 1955. This series of drill rods offers a number of advantages over the old "E", "A", "B", and "N" rods.

The larger diameter with respect to that of the drill hole accelerates the removal of drill cuttings which, if not flushed out, can cause serious difficulties in the drill hole. The tighter fit substantially reduces rod vibration which adversely affects core recovery and diamond bit life. The stiffer rod and improved thread minimizes elbowing at the coupling and bending which may cause twist-offs and expensive fishing jobs.

The larger inside diameter of the coupling makes it easier to furnish ample fluid at the core barrel and helps to prevent overheating the drill bit.

Industrial Diamonds

The industrial diamond has always played an important part in exploratory drilling. It is worth while to note that today, in addition to the natural diamond, there is available a product which is sometimes referred to as a "processed" diamond. In many instances, this type of diamond has given very favorable results in the United States and particularly, as reported recently, in Canada where it has been used to advantage in drilling relatively hard, crystalline rocks.

Diamond Bit Design

The design of a diamond bit to provide optimum performance in a specific rock formation or combination of formations occurring within specified areas has proven to be of great value to the user. Unfortunately, however, many exploratory drilling projects are short-lived, and the development of the best design cannot be accomplished within the limited time available. In such instances, the best answer seems to be a good, all-around bit made to perform satisfactorily under average conditions.

In those instances, however, where exploratory drilling programs endure over a period of many months, there is an opportunity to carefully analyze the conditions and requirements and then design a product which will provide the best overall results at the lowest cost per foot.

Many examples of the results of proper bit design can be cited. Time will permit the mention of only a few. In drilling a cherty dolomite located in the Lehigh Valley in Pennsylvania, it was found that a small stone bit with square crown reduced diamond bit costs by 28 percent. Again, near Grants, N. M., the problem of rapid penetration was solved by designing a bit using large diamonds and providing a specially shaped crown with maximum fluid relief across the face and around the bit. Here, penetration rates were increased by 100 percent. In northern Michigan, a diamond bit was developed which reduced the diamond bit cost 10 percent and increased the penetration rate from 20 to 60 feet per eight-hour shift.

The essential factors involved in bit design normally include size, exposure, shape and quality of diamond, conformation or shape of the bit crown, relief provided for the circulating fluid, and the matrix or material which holds the diamond in the bit. Optimum results with the diamond bit can be assured only if there is sufficient time and opportunity to develop the design which will most efficiently cut those rocks being drilled.

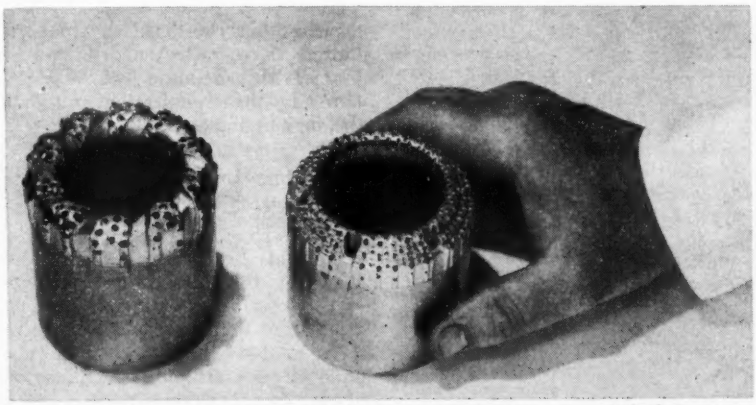
Combination Plug and Core Drilling

Certain drilling programs can be advantageously carried out by utilizing two different types of drill rigs; namely, the shot hole type drill used extensively by the petroleum industry and the conventional diamond core drill.

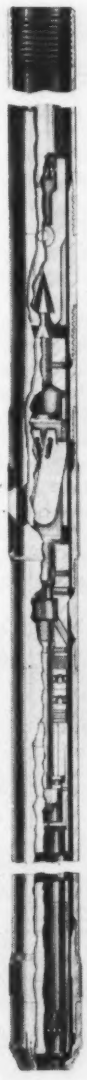
In those instances where strata covering or material away from the ore horizon are not of significant importance to the geologist, it has been found desirable to consider drilling that section of the hole (the insignificant strata) with the shot hole type rig where very rapid penetration rates can be realized if the formation is relatively soft. As soon as the target or mineralized section is reached, a diamond core drill with adequate coring tools to assure high core recovery is used to complete the hole.

Mobile Drills

The mobility secured through unitized truck, trailer and scow mount-



Each of these unique diamond bit designs was developed over a period of time to meet specific drilling conditions. Both resulted in substantial reductions in diamond bit cost per foot drilled



The Wire Line Core Barrel has a retractable inner tube assembly which makes it possible to recover core while the drill rods remain in the hole. Note that the latching device, which is lowered on a Wire Line Cable, is here gripping the spearhead of the inner tube. Upward pull of the cable will bring the core-bearing inner tube to the surface

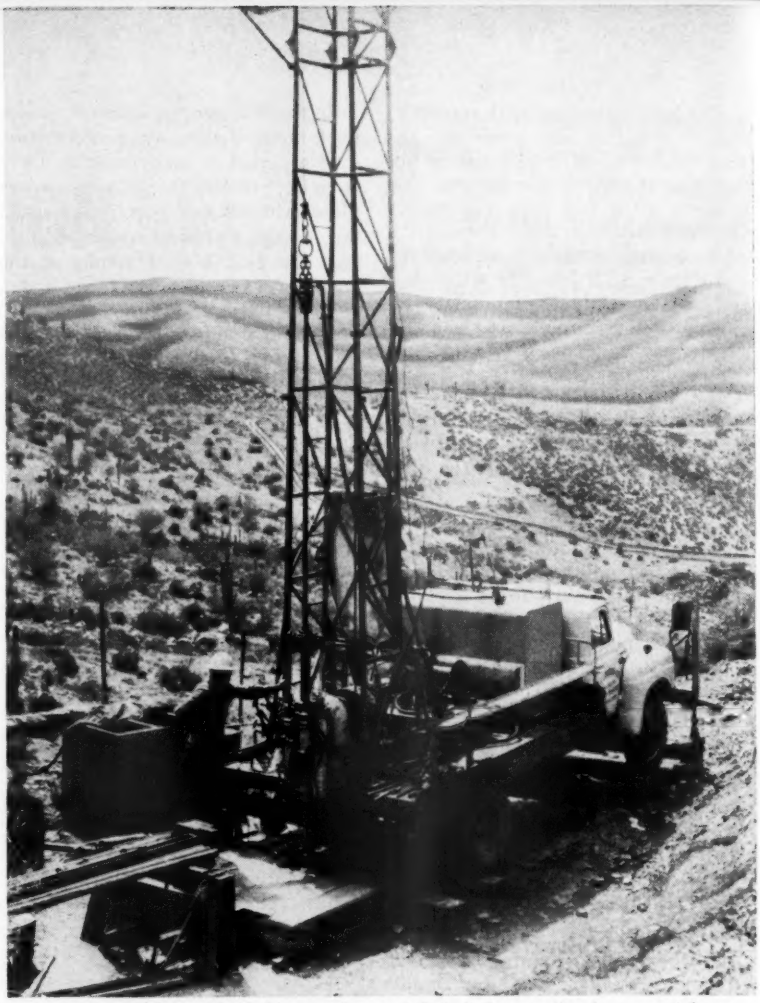
ings has contributed substantially to increased overall drilling progress. Mobility has reduced down time resulting from rigging and moving operations from one drill hole to another. Since both angle and vertical holes can be drilled by using the angle hole type mast, the tripod which was previously necessary for angle hole drilling has virtually vanished.

Wire Line Tools and Technique

Since its introduction in 1953, the wire line technique together with its tools has been adopted and used with outstanding success in many parts of the world. A few countries outside North America in which wire line has met with enthusiastic acceptance, includes France, Germany, Norway, Chile, Peru, Northern Rhodesia, and the Union of South Africa.

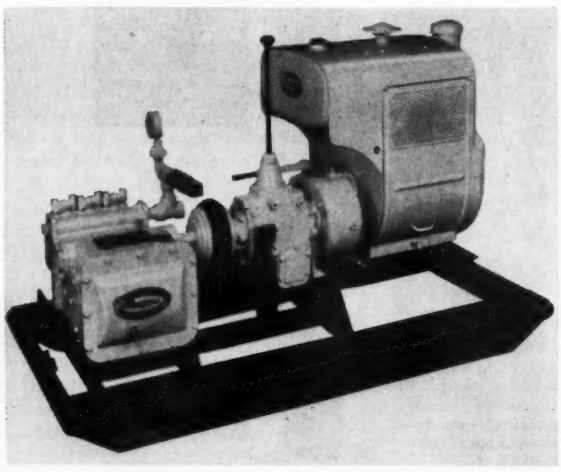
As the wire line has been improved, the users have found that, in addition to greatly improved core recovery in difficult coring ground, the wire line can also be advantageously applied not only to drill holes in excess of 1000 feet but to shallow holes ranging down to 100 feet in depth. It now appears that the only serious limitation to the advantageous application of wire line is in very hard, massive formations where bit life is somewhat less than 50 feet.

Now that we have reviewed some of the more important recent developments which have improved exploratory drilling performance, let us look at some results as recorded by a contracting firm from 1947 through 1957. During this period, the average earnings of drill crews was increased by 78.5 percent; the cost of supplies other than diamond products increased 121 percent; the cost of diamond bit products increased 30 percent. As a consequence, the average expense incurred per eight hour shift increased 87 percent. However, because many of the newly developed techniques, materials and equipment were utilized, the average sell price was not increased—instead it was reduced 11 percent.



This powerful four-wheel drive, truck mounted rig is in operation in a mountainous section of the Southwest. Considerable time is saved in moving from drill site to drill site and in setting up. The rig carries a variable volume-and-pressure pump, rod storage racks, and uses a hydraulically raised steel mast which replaces the driller's tripod

Also significant is the fact that, during the ten-year period, through the application of new methods and tools, overall drilling progress was increased by an average of some 25 percent. This not only helped offset increased expenses but shortened the time required to complete the drilling programs. This reduced the expenses borne by the organization providing the engineering staff.



Variable volume-and-pressure transmission pumps have done much to improve drilling operations. By shifting gears on the pump the drill operator can vary fluid and pressure output to meet conditions in the hole. This makes it possible to control the coring cycle through "closed-circuit" pumping. The latter helps improve core recovery and minimizes diamond bit wear

Future Improvements from Research and Development

Recognizing that research and development have been effective in stemming the tide of increased operating costs, it is of interest to look at some of the future possibilities in terms of those things which are now under development and which may be of considerable value to those engaged in exploration drilling.

(*Continued on page 75*)



By
JOHN R. KARNAP
General Manager
Elm Development Co.

HIGHWALL AUGERING

With a Twin Auger

AUGER mining is a relatively new development in coal mining. Since it was introduced to the industry, the method has grown to where it now is responsible for approximately 10,000,000 tons of coal per year. It can be used successfully in strip pits and on bench operations where coal cannot be economically mined by stripping.

The method can be very helpful in proving reserves and quality of coal on new properties. By auger mining, prospect information and access roads are made available before deep mining begins if the operation is properly planned, engineered and supervised.

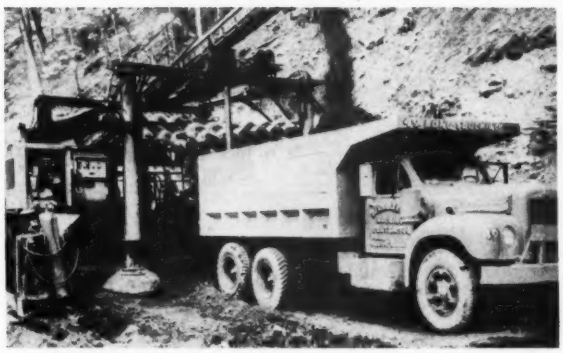
With the early augers the machine operator had little control over the direction of the auger head as it penetrated into the coal. The maximum depth of auger holes was limited to 60 ft, with the average less than 45 ft.

In the early 1950's improved machines were put on the market. These augers were available in diameters ranging from 24 to 60 in., with a maximum drilling depth of 150 to 220 ft, and were capable of producing over 700 tons per unit shift. However, the smaller diameter auger production was low, and thin seams and thin coal areas were skipped.

In July 1957 a 24-in. diameter twin auger was introduced. This machine has made possible the profitable augering of thinner seams of previously developed coal properties as well as the development of new properties.

Twin's Production Comparable to That from 36-In. Auger

The new auger unit is 34 ft long, 19 ft wide and 15 ft high. It carries twenty-two 12½-ft auger sections and two 24-in. auger heads tied together by a steel bar connecting two tapered roller bearings. Powered by two diesel engines, the twin auger has a maximum drilling depth of 150 ft and weighs 26 tons. One 175-hp engine feeds the augers into the coal by a self-driven winch that pulls the carriage along its rail mounted frame. One 100-hp engine drives a hydraulic system that operates: a 30-in. conveyor which carries coal from the auger to the haulage trucks; an overhead crane, and frame jack lifts located in the four legs. The jack lifts are eight in. in diameter with a lift of 54 in. This allows drilling over and under large partings and drilling overlapping holes.



Five - man crews average 420 tons per shift in 30-in. coal seams with a 24-in. diameter twin auger

Production obtained from the twin auger is nearly double that obtained with a single auger the same size in diameter, with an initial investment approximately one-third more.

The twin cutterheads work close enough together to permit the rib of coal above and between them to be removed during the auger operation, and calculations show the total recovery of the augered area is increased by ten percent.

Elm Development Co. records show the 24-in. twin, which is the smallest, produces tonnages which are comparable to that from a single 36-in. auger, which in turn provides tonnages sufficient to command a volume market as well as justifying the initial development cost of the auger operation.

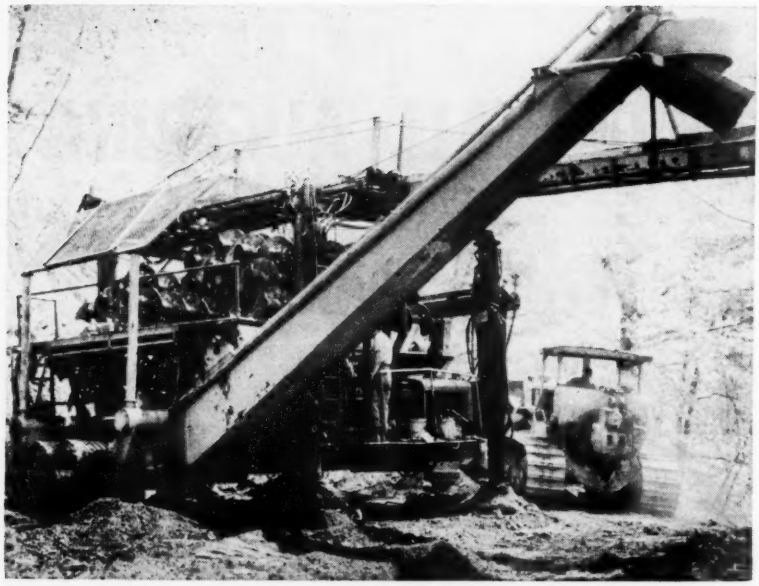
Some of the seams that have been developed for augering as a result of the twin auger are Jellico, Hazard No. 4, Swanee, Powellton, Sewell, and many seams with thin coal above and below large partings.

Five-Man Crew Used

The equipment required for an auger operation depends upon the type of job to be done. For example, the equipment used on Elm Development's present bench operation, operating in 30-in. coal, consists of one D-8 facing bulldozer, one D-8 bulldozer that moves the auger along the highwall, and one Model 28, 24-in. Twin Compton Auger.

Five men are employed to operate the twin auger each shift. Of these, one operates the facing dozer, one operates the carriage, one operates the hydraulic system, and two handle the auger sections and operate the pull dozer at the end of each cycle.

The number of trucks used in conjunction with the auger unit depends on the length of haul and road conditions.



The twin auger has a maximum drilling depth of 150 ft and weighs 26 tons

Unit Averages Fifteen 100-ft Holes Per Shift

Maximum depth the auger will drill is 150 ft. However, rolls and highwall conditions have cut Elm Development's present average depth to 100 ft. The completion of each hole is a cycle, and an average of 15 cycles are completed in an average 7¼-hour shift, or 28 minutes per cycle. Production averages 420 tons per shift or 28 tons per cycle.

The information listed below is posted on the mine map each week after an area has been completed, and shows the exact location of outcrop, changes in seam heights, and the quality that can be expected in different sections of the deep mine.

Number of holes augered per day ———
Ft of outcrop used per day ———
Tons of material augered per day ———
Tons of material per hole ———
Tons of material per ft of outcrop ———
Depth of each hole ———

Analysis of coal per shift and the percent of each size coal shipped per day.

ARE A-C SECTIONS PRACTICAL IN D-C MINES

(*Continued from page 64*)

is a bare minimum, because there is less detailed work than is required with d-c machinery and switchboard. The extension of a-c transmission cable is less expensive and easier than its counterpart, the d-c feed line. A-C cables, under 7500 volts, usually have preassembled couplers, with cable size being smaller, making it simpler to install and couple up. Likewise, recovery of a-c cables is easier and cheaper.

Cost of a-c power equipment is much less than equivalent d-c equipment. The cost of the power transformer for an a-c installation is about 25 percent of the cost of equivalent conversion equipment. An additional piece of equipment required for an a-c installation is an underground switch house, for branching off the main transmission cable. The cost with the additional equipment is well below half the cost of d-c conversion equipment. Transmission cable costs make up the greatest portion of the a-c installation cost and, being a much smaller size for the a-c installation, should about equal the cost of the larger cables required for the d-c installation.

Another important factor is that power operating costs with an a-c system are less. D-C conversion equipment is usually run continuously, so that considerable energy is non-productive; with a transformer, only a small excitation current is required. Also, in d-c conversion equipment the efficiency is much less than in a transformer. Line losses on a-c installations are much smaller, due to the fact that the higher voltage is brought closer to the utilization point and then is only transmitted a maximum of 1500 ft at low voltage. Line loss on a d-c system can be as much as four times greater than the loss on a low voltage a-c system.

Less Maintenance with A-C

The electrical maintenance requirement on a-c systems is practically non-existent as compared to a d-c system. Because there is no need for conversion equipment, there are not the maintenance problems of a normal d-c substation. At the machine there are no brushes, commutators, or complicated starting controls to maintain. Motor failures, due to high current caused by low voltage, is no longer a problem because the a-c motor will not run when the voltage drops much below normal. Cable lengths are limited so that voltage regulator is always kept within normal range.

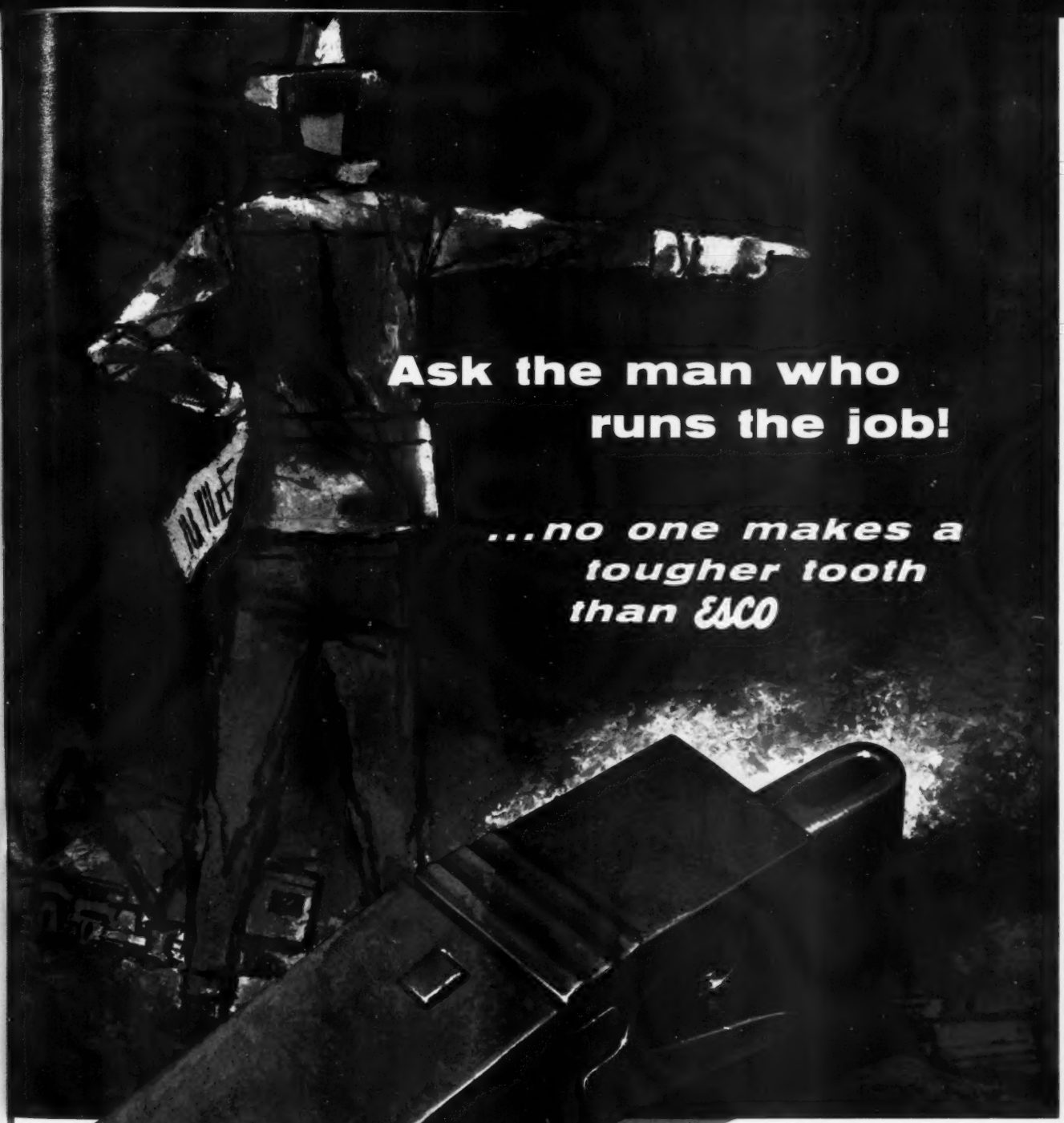
Location of cable faults on a-c equipment trailing cables is somewhat of a problem because, like d-c faults, the fault usually clears before any visual damage is done to the cable. There are fault detectors on the market which have proven adequate for finding the various types of faults.

One problem yet to be solved with high voltage a-c systems, is a means of locating faults in the high voltage cables. Although there are systems developed for utility service, they are not practical for mine service, being too complicated and expensive.

The improvement in safety of a-c power systems over d-c systems is impossible to evaluate. Ground continuity check circuits, continuously monitoring continuity of ground wires, prevents operation of the system in the event of loss of grounding continuity by immediately removing power from the cable. A ground limiting resistor at the transformer neutral limits the voltage rise above ground during fault conditions, to a safe value, and immediately removes all power on the underground system. Ground fault relaying at the underground load center limits fault conditions on portable mining equipment and immediately isolates faulted equipment.

Use of a-c power equipment with a properly engineered protective system has greatly eliminated the fire hazard present with d-c equipment, because faults clear quickly and are normally confined inside the cable.

It is a foregone conclusion that the a-c power system will replace the d-c systems in mining operation, but as for the use of a-c equipment in d-c operations, that will have to be decided on an individual basis of each operation.



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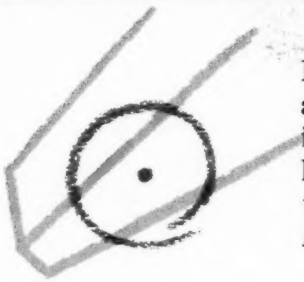
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Principles of the Flow of Crushed Materials

By
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The failure and flow of rock masses are everyday problems to the mining engineer, but stress analysis of rock masses has not been developed to the point where it is of value in predicting the behavior of rock. Nevertheless, the advent of the computing machine offers promise of mathematical solution of all typical problems in due time. First in line for analysis is the failure and flow of crushed material.

TO the mining engineer the failure and flow of rock masses are every day problems. Both these problems belong in the field of stress analysis: it would seem therefore that the mining engineer should be an expert stress analyst. The fact, that for the most part he is not, is but evidence that stress analysis of rock masses has not been developed to the point where it is of value in predicting the behavior of rock.

For a successful stress analysis we need to know the stress field and the strength properties of the rock throughout the mass. If we know those, we can predict how the rock will fail and how it will flow. It may be difficult to obtain the answers, but with the advent of the computing machine there is no doubt that in due course all typical problems will be worked out mathematically. In the order of complexity, the first problem which suggests itself for analysis is the failure and flow of crushed material; here we already have some concrete solutions. The next problem is that of unbroken soft rock, and the last and the most complex is the problem of unbroken hard rock, because there the difficulties are compounded by the geological history of the mass and the resulting unknown residual stresses. In soft rock the residual stresses are less significant because they tend to dissipate as they arise.

Computer Provides Solution in Reasonable Time

In crushed material the stress conditions can be predicted with sufficient accuracy, provided the material is charged into storage without excessive impact. However, even the solution of failure and flow of crushed material is difficult. To illustrate, it will suffice to say that it takes six values to describe the stress at a point. For instance, the state of stress in the infinitesimal cube (figure 1) is described by three pressures σ_1, σ_2 and σ_3 and three shears τ_{12}, τ_{23}, τ_{31}. A complete solution requires the determination of these six values at every point of the mass. Analytical solutions are not available; it is necessary to use finite difference, numerical methods, and it is only with a computer that one can hope to arrive at solutions within a reasonable time.

The possibility of using experimental stress analysis should not be overlooked. However, a number of obstacles stand in the way. In the first place, if we want to measure the stress at a point in the rock, we have to place some kind of a gage there. Irrespective of the problem of placing the gage, we have the very serious complication of local stress redistribution due to the withdrawal of some of the material from the point in question and the replacement of the material with a gage which is likely to have different stress-strain relations, thus affecting the measured values. And then we need six gages to give us the six stresses at the point. These difficulties seem to make it impractical to use gages for purposes other than checking an estimate or a mathematical analysis.

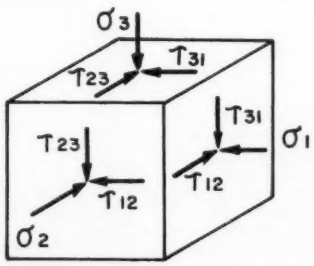
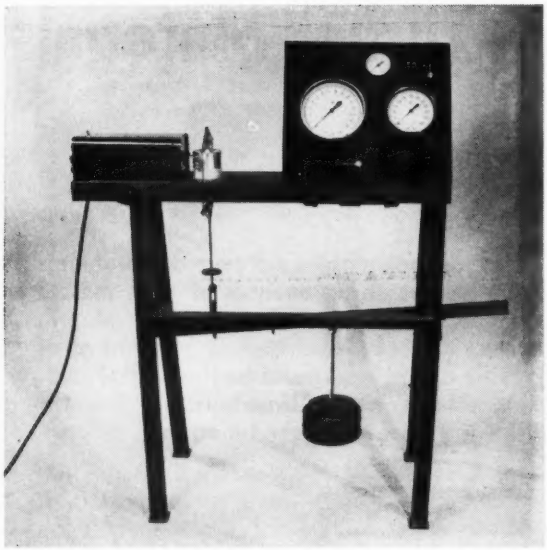


Fig. 1. The state of stress in an infinitesimal cube is described by three pressures and three shears. A complete solution of the stress conditions in a mass of crushed material requires the determination of these six values at every point of the mass. Only the use of a computer offers hope of solution within a reasonable time

So far as the strength of materials is concerned, methods have been developed to measure the strength of rock[1] and of crushed material.

The reader will note that from the beginning the authors have mentioned the failure of material and the flow of material. This has been done purposely to emphasize that we have here two distinct stress-strength conditions. Failure refers to an abrupt development of slip planes in a previously stable material. This is accompanied by a volumetric expansion of the material. Flow refers to the state in which material is continuously flowing through a defined channel. During flow the volumetric change is small and it may be either expansion or contraction.

Failure seldom occurs simultaneously throughout a channel. It usually proceeds by steps which may follow each other immediately or may spread over minutes, days and months. For instance, subsidence often takes years to break through to the surface. One reason for this is that as the bottom layer of the rock fails, expansion takes place and the



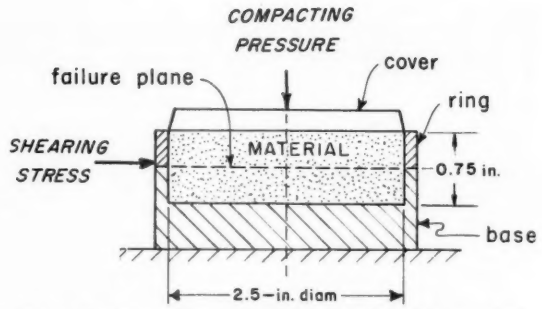


Fig. 2. Single cell flow-factor testing machine (left) and test cell (above)

broken rock fills out the vacant space. It takes time for the broken rock to reconsolidate sufficiently to cause a new vacant space to develop into which a higher layer of the rock can expand.

Experiment Station Studying Stress and Velocity Fields

At the Bulk Solids Flow Laboratory of the Utah Engineering Experiment Station at the University of Utah researchers are now engaged in a mathematical study of stress and velocity fields for the steady flow condition of solids in two dimensions; later they propose to expand this work to some three-dimensional problems. This work is carried out under the sponsorship of the National Science Foundation. The results of this work will help in the understanding of the failure and flow of broken rock. Note the use of the adjective "steady". This is important. Considering flow from the standpoint of conservation of energy, we have a certain energy input into the material as the material flows down in the gravitational field. Assuming that the velocities are sufficiently small for dynamic and viscous effects to be negligible, in steady flow this energy input is dissipated through plastic work done on the material. For a given material the steady flow condition will be satisfied only for certain shapes of the channel. For other shapes the input energy may be too small to do the necessary plastic work and material will stop flowing. For still other shapes, the input may be in excess of the energy required to do the plastic work in steady flow and that excess is dissipated by producing pulsating flow. Scientists expect that the mathematical analysis now in progress will assist them in determining the most suitable flow channels.

So far as the properties which govern the failure of a material are concerned, it seems that the unconfined compressive strength, which the material develops under a given consolidating pressure, is of principal importance.[3,4,5,7,8] As this appears to be the most important flow property of a material, it is called the flow factor of the material. All solids consolidate to some degree when pressure is applied to them. Thus, a broken ore, which is quite free flowing when discharged over the head of a conveyor on top of a bin, will form a pile with an angle of repose of 30 or 40 degrees, but the same ore may form steep craters around discharge openings and may dome across those openings. The ore under pressure from overlying layers has consolidated and has gained strength. This property of materials to develop strength as a result of compaction is brought out in the flow factor function.

It is necessary to call attention to one important factor which can greatly modify both the flow pattern and the strength of a material. This factor is dynamic compaction which occurs when material is dropped into the bin or on to the storage pile from some height. The pressure at the point of impact can be appreciable even from a stream of fines. With large size material, impact pressure can exceed by far the pressures of steady flow. While the impact of fines can be made negligible by spreading the stream over a large area of the bin, the impact of the large lumps cannot be entirely eliminated. The impact of the large lumps tends to

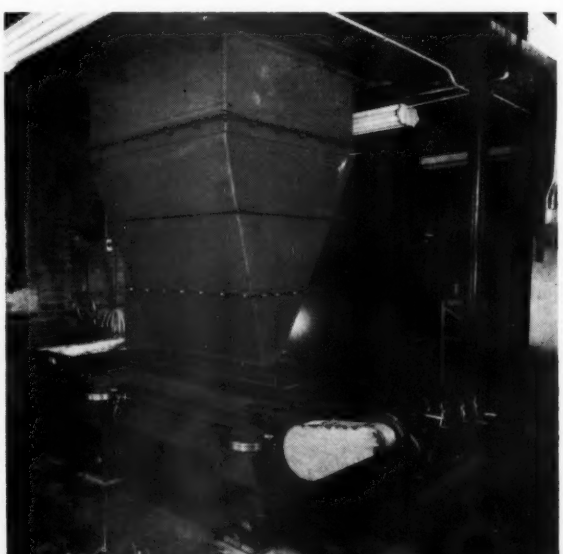


Fig. 3. Lower portion of experimental bin. The belt-feeder under the bin allows measurement of the pressure of the material flowing onto the feeder and the pull necessary to draw material out of the bin

wedge the material in the flow channel and that wedging is particularly severe in steep steel hoppers. Wedging is least pronounced in flat bottom bins which should be the rule for coarse ores. In many cases impact accounts for the irregularities of flow and for the progressive loss of live capacity of the storage plate.[6] When arching of material occurs after the level of material has been allowed to run low in a bin, it is good to check whether the stream of falling material does not hit the critical area, and to install spreader or deflector plates if it does.

Provided we have eliminated the influence of impact, the channel which material will form after failure seems to depend mainly on the shape of the outlet, on the flow-factor of the material, and on the time material is allowed to compact.

Strength Dependent On Fine Material

Now a question arises: how can we measure the strength of a material composed of all sizes from fines to large lumps? The strength of a chain is that of its weakest link. Similarly, the strength of a material is that of the frictional and cohesive forces between the particles. During failure and during flow, the large particles move bodily while material shears across the fines. Provided the throat of the channel is sufficiently large to prevent interlocking of the large lumps, the strength of a mass of material depends on the properties of the fines. Screened coarse ore is invariably free flowing. The coarse particles are a passive agent, like aggregate in concrete, they cannot develop strength without fines to bind them. Fines, whether in unscreened ore or as a screened out fraction, often cause material to arch and to hang-up. To measure the flow properties of a broken material, therefore, researchers screen out the fines, compact them and measure their strength.

For testing a direct shear, constant strain-rate apparatus, called the Flow-factor Tester, is used. The main part of the apparatus is a test cell in which a specimen of the material is compacted and then sheared. (See figure 2.) The vertical compacting pressure is applied by means of a weight, the horizontal shearing stress by means of an electric-pneumatic device which advances a stem at a constant rate against the resistance of the ring and produces an air signal whose pressure is proportional to the force acting on the stem. The air signal is indicated on the recorder. From six tests enough information is obtained to determine the flow factor of the material for a given time of compaction, moisture content and temperature.

It should be stressed that the flow factor of a given material is the function of the time of compaction, moisture content of the material, and temperature. These parameters affect different materials to a different degree. The metal ores and concentrates that have been tested require the consideration of time and moisture. Thus, if it is expected that the plant will be frequently stopped over two-day weekends and the moisture varies between eight to 10 percent, the tests would be carried out for a compaction time of $48 + 16 = 64$ hours and for two moisture contents: 8 percent and 10 percent.

The purpose of the Bulk Flow Project is: to streamline the method of measuring the flow factor of materials; to determine the reasonable flow patterns; and to determine the bin shapes and sizes which will give reasonable flow patterns for materials of a given flow factor.

In the Bulk Solids Flow Laboratory an experimental bin, 42 in. square and 12 ft high, is equipped with hopper outlets and flat bottom outlets varying in width between three and 18 in. and in length between 15 and 42 in. The lower part of the experimental bin is shown in figure 3. The belt-feeder under the bin allows measurement of the pressure of the material flowing onto the feeder and the pull necessary to draw material out of the bin. The laboratory is equipped with a recirculating troughed belt conveyor-elevator of a novel design[9] which allows project workers to circulate material through the experimental bin with a minimum of attrition.

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EXPLORATION DRILLING TECHNIQUES

(*Continued from page 68*)

Today we have the man-made diamond, the phenomenal product of General Electric Co. The man-made diamond has already found a place in our industrial market. It is being successfully applied in diamond wheels for shaping hard materials. While there are no reports that the man-made diamond has been applied to diamond core drilling, further research and development in the near future may economically produce diamonds comparable to those which we today use in diamond bits.

There is a new substance known as "AM-9 Chemical Grout" which is now in the process of being field tested. This material appears to have interesting possibilities as a drill hole stabilization agent. In porous, fractured or unconsolidated material it can be injected ahead of the bit. The grout rapidly sets, thus consolidating the material so that it can be cored.

Under development and being tested is an intriguing core barrel known as "The Rubber-Sleeved" core barrel. Tests made by the petroleum industry have produced some very encouraging results in coring loose sand and gravel.

Percussive down hole drilling tools, applicable to small diameter holes, are being developed. Likewise, considerable effort is being expended to perfect the small-diameter, turbine-type, rotary down hole drilling tool. The prospect of successful application of down hole drilling tools, because of certain favorable economic aspects, provides those engaged in exploration drilling with the possibility of substantially increased drilling progress, particularly through strata from which core samples would not be required.

The manufacturers and drilling contractors have found and will continue to find, through research and development, better tools and methods with which to supply the exploration needs of a strong and vital mining industry actively exploring and developing new mineral deposits.

PREVENTIVE MAINTENANCE in Low Coal Mining

By
WALTER CRACE
Superintendent of
Power and Maintenance
Princess Coals, Inc.

Princess Elkhorn Division of Princess Coals, Inc., has long been concentrating on better maintenance practices. Everything from a complete mine mechanics course to provide necessary trained personnel to a unit changeout system of preventive maintenance to eliminate time consuming major repairs and replacements have been utilized by the company in a well planned program that has paid off in less downtime and improved production rates

THERE are many axioms describing the value of preventive measures—the need for an ounce of prevention, or for a stitch in time. There is an important economic application for controlling the effect by controlling the cause. Industry has found how to achieve substantial savings by applying preventive action and controls that remove or reduce causes of lost man-hours, idle equipment and excess supply costs.



At David, Ky., the Princess Elkhorn Coal Division of Princess Coals, Inc., operates in coal heights of 29 to 33 in. These conditions taught the company sometime ago the need for a better-than-average maintenance plan. The severity of competition, within and outside the industry, requires the low coal operator in particular to bring excess cost factors quickly under control.

First Need Was Education

The maintenance and industrial engineering departments of Princess Elkhorn have long been concentrating on the development of better maintenance practices. One of the first needs to be met was the short supply of manpower skilled enough to perform the class of repair work a good maintenance program required. The need for better trained men was discussed with the Mayo State Vocational School nearby, and a complete mine mechanics course was started at the school. To start the course, the company obtained help from several mining equipment manufacturers who supplied blue prints, drawings and catalogues. Other companies donated or loaned mining equipment for class work. Several of Princess Elkhorn's supervisors acted as instructors.

The full course consisted of 2400 to 3200 hours of shop practice and machine work such as lathe, milling machine, drill press, shaper, welding, motor winding, panel boards and control wiring, blue print reading, drafting and other related subjects. Many young men had just returned from war services and were looking for work. Untrained but willing, they were glad to take this training under the G. I. Bill. Upon graduation, Princess Elkhorn, and other companies, hired these men as helper trainees in maintenance.

Princess Elkhorn also encouraged present maintenance department employees to enroll for special training at Mayo in welding, hydraulics, panel wiring and controls, and blue print reading. The company paid the full tuition and has had as many as 51 men a year enrolled. This program is still active.

In conjunction with the Mayo program, training classes on the job were started to improve mechanics. Two-hour classes were held twice weekly for ten weeks. Refresher courses in hydraulics, panel wiring, lubrication, bearing maintenance and gear fits were taught. Question and answer discussions were held to teach the technique of trouble shooting.

The company's own experienced supervisors taught most of the classes. Periodically, some mining equipment manufacturers furnished special instructors, as did oil and bearing companies on lubrication and bearing maintenance.

This type of program was followed for three years. By this time approximately 30 per cent of the company's underground maintenance force were graduates from Mayo State Vocational School. Four are now maintenance supervisors and four have been transferred to the production department as foremen.

Then A Maintenance Program Was Designed

By 1956 Princess Elkhorn felt that it had the trained personnel needed for a successful maintenance program. The unit changeout system of preventive maintenance was inaugurated in an effort to eliminate time-consuming major repairs and replacements. Through conferences with maintenance supervisors and industrial engineers, it was determined how many complete units on face equipment could be changed out underground. Approximately 70 unit assemblies were decided on. Most of these were on three pieces of equipment: loading machine, shuttle car and cutting machine. The life expectancy or change cycle on all unit assemblies was set by the maintenance supervisors from records available and from experience. As experience dictates, revision is made to the schedules both as to the units to be included and the frequency of changeout. To furnish a foundation for the program, several additional unit assemblies were purchased. A well-planned spare unit supply is important.

A master schedule board was made up showing all of the different unit assemblies scheduled for changeout. The first column on this board shows the unit assembly, the number of active units of this type in service at the company's two mines, the number of spare units and the frequency of change. The rest of the board is a 12-month calendar with four tag holders in each square denoting a month. For any item scheduled for changeout, say in March, a red tag is placed in the March square. This color denotes that a unit is scheduled for that month. The tag contains information as to which section and which position the unit is to be changed. When the changeout is completed a geen tag is placed over the other two denoting change completed and ready for rescheduling. At the first of each month, maintenance supervisors receive a full report showing all units to be changed out during that month. Dates of changeout completion are filled in by the supervisor and returned to the maintenance clerk at the month's end for permanent record.

Good records are vital to the program. There is, of course, the ever present danger of initiating too much paper work, but there is a necessary minimum.

A full-time clerk was assigned to do the paper work and record keeping. Many different types of forms were designed to gather permanent information such as:

1. Production and delay reports
2. Equipment check list
3. Central shop rebuild forms
4. Unit assembly tag
5. Unit assembly operating repair summaries
6. Unit assembly changeout schedule
7. Monthly summaries of delay time

In setting up these forms every effort was made to keep writing time to a minimum for the foremen so that only a check mark was necessary instead of a lengthy written explanation.

To provide more effective control, the work load for the maintenance organization was carefully scheduled. Particular care was taken to see that third shift maintenance supervisors underground were not over-loaded. The most important changeout work is done on this shift. Hasty work is costly. There is a maintenance supervisor for each three mechanical units, and two mechanics for each unit. They are responsible for making all unit changeouts, cable replacements, and chassis and body repairs on the face equipment.

The unit changeout program under favorable conditions would ordinarily reduce the work load of underground maintenance personnel. In 29 to 33-in. coal heights the equipment receives more severe wear to frames and chassis than it would under more favorable height conditions. For this reason, and because of the transportation problems in low coal, the company has not been able to reduce underground maintenance forces to any extent.

Work load on the central shop has been greatly increased, but it is being performed by the same number of men. This has been accomplished by re-engineering the shops to fit this type of program.

There were, of course, many details of change and improvement involved. A few are mentioned as examples.

And the Shop Was Redesigned

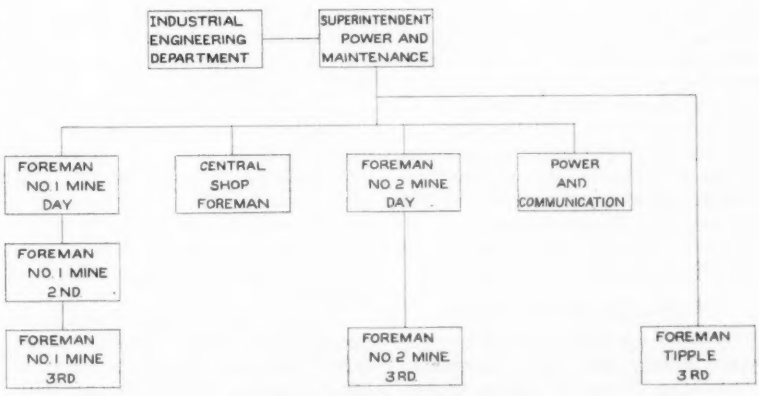
Desk type work benches with storage compartments and sliding tool drawers were built for each unit assembly. Each assembly bench was completely stocked with parts to build that particular unit. Each man was assigned a work area in which he would build one or more units. Better lighting, electric impact wrenches and air operated grease guns were provided. A special cleaning tank was installed for degreasing changed-out units before disassembly. The shop was insulated and a central heating plant installed. Fans were put in for summer comfort.

The company rebuilds its hydraulic pumps and motors. A special test bench was made to test for volume and pressure at various speeds before the pumps and motors are put into service.

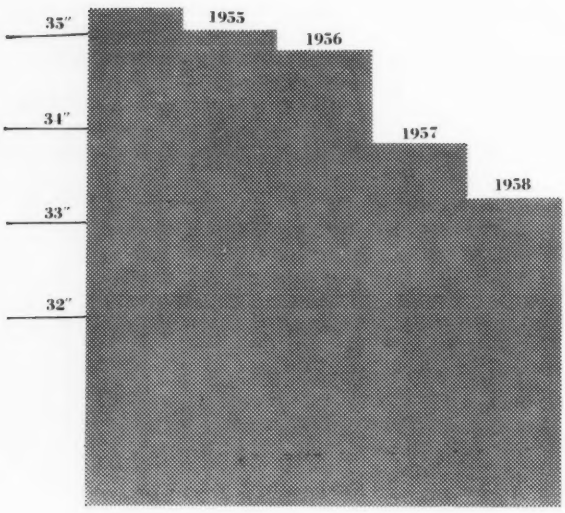
Because height conditions do not allow the use of large motors, it is often difficult to install a motor that is large enough for the job. This marginal situation results in excessive overloading with its effects on motor life. In setting up test standards, extreme care was used to insure that motors passing the test would give maximum service.

A low scale volt meter is used for testing the drop across fields which have been in service. Air gaps are kept to the manufacturer's specifications.

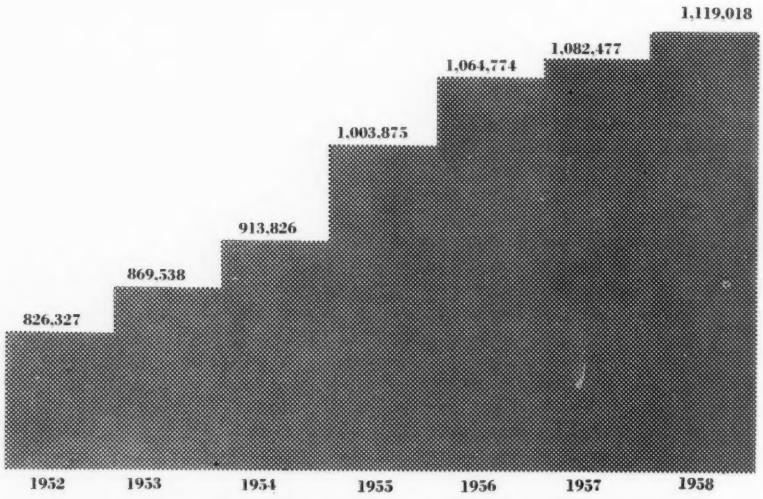
A test unit was built using a hydraulic pump and throttling valve for



Organization chart of Princess Elkhorn



Constantly diminishing coal heights have made the company's production time increasingly valuable



Using the same number of mechanized sections, Princess Elkhorn has increased production 35.4 percent since 1952. Delays have been controlled to the extent that a substantial amount of this tonnage improvement can be attributed to less downtime

loading. This pump is driven with a V-belt drive by the motor under test. One pulley is used on all motors, through the use of bushing adapters for different shafts. A motor-generator set is used for this testing job only to insure constant voltage. All d-c motors, up to and including 15 hp, are tested 30 minutes, each rotation at 100 percent name plate load, then 15 minutes, each rotation at 150 percent load. The speed and temperature rise and all test data are recorded for permanent record.

Other Checks Are Made

A follow-up check of equipment is made underground by maintenance supervisors to see if proper lubrication methods are being met. When a non-scheduled unit is changed, the shop makes a careful inspection to learn whether faulty lubrication was a cause for the changeout. All personnel are notified if poor lubrication is in evidence.

An engine cannot give maximum performance when it operates on low-grade fuel. Weak power is equally damaging to mine equipment. Adequate circular mil feeder capacity is carried on both positive and negative to the section nipping points to insure as near name plate voltage as possible.

Through these improved and more exacting standards and methods, shop personnel have acquired a higher level of skill and productivity. A wide range of work can now be performed. For example, last year the shop redesigned and rebuilt a conventional coal loader into a high capacity low coal loader measuring 25¼ in. high and having a 15 in. coal line.

Program Has Worked Well in the Tipple

Application of the unit changeout system to the tipples yielded very good results. Delays were reduced 46 percent in a year. In the course of bringing the delays under control, a better equipped plant was achieved.

For example, undependable conveyor chain was replaced with belt; on chain and flight conveyors, speed reducers were changed from spur geared to worm geared design; slip couplings replaced direct couplings on conveyor lines; double and triple vibrators were installed in place of eccentric shakers; BX armored cable was replaced with three-conductor rubber-covered motor and control cable.

Tonnage Increased 35.4 Percent

This description likely indicates that a preventive maintenance system is an expensive operation. There was a substantial initial cost in acquiring spare units, effecting method improvements and modernizing the shop. However, these expenditures can prove to be good investments if they provide a means to convert wasted delay time to production time.

Constantly diminishing coal heights have made the company's production time increasingly valuable. Delays have been controlled to the extent that a substantial amount of tonnage improvement can be attributed to less downtime. Using the same number of mechanized sections, the company produced 826,000 tons in 1952 and in 1958 over a million tons, an increase of 35.4 percent.

In the meantime, maintenance supplies and parts were undergoing regular price increases. The company's ability to improve production held its maintenance supply cost increase to six cents per ton in the 1952–1958 period.

Management has learned again that improvement breeds improvement. Stimulation is felt throughout an organization when better methods make work more productive and effective. Everyone reacts to these accomplishments. This maintenance program has made Princess Elkhorn a better organization. It intends to continue to seek better ways to mine coal.

URANIUM MINING in WYOMING

By

ALBERT V. QUINE

General Manager
Lucky Mc Uranium Corp.

Low, rolling, sandy hills, covered with sagebrush and brunch grass. . . . A few isolated erosional monuments with the sharp hogback ridges of the Gas Hills anticline dominating the surface. . . . Dry and dusty, with whirling dust devils the only companions of scattered bunches of cattle, jackrabbits and antelope. . . .

Such was the picture of the Gas Hills area of central Wyoming on September 13, 1953 when Neil McNeice observed the wild fluctuations of his $50.00 geiger counter which led to the discovery and development of uranium deposits with an eventual assured production of over $700,000,000.

This area, known as the Gas Hills Uranium District, is located almost in the exact geographic center of Wyoming approximately 50 miles east of Riverton and 70 miles west of Casper.

The bulk of the presently known ore deposits are located within an area 12 miles in length and three to four miles in width, with the larger deposits located on and to the west of the west flank of the anticline.

Ore Deposition Related to Ancient Stream Channels

Geologically, the ore occurs principally in the coarse-grained, relatively unconsolidated facies of the Upper Wind River formation of the lower Eocene of the Tertiary period. The ore zone appears to be limited to the lower arkose sand of the Wind River between 200 and 300 ft in thickness, and from what geological knowledge is available, seems to be directly related to ancient stream channels which may or may not follow the present drainage pattern.

A plan view of the principal ore deposits of the Lucky Mc holdings definitely shows the meander pattern of an old channel with offshoot zones apparently related either to the oxbow portions or to tributary influence.

No definite theory of ore genesis has been agreed upon; however, a concensus of opinion points to the leaching out of the extremely low grade uranium content either from the upper arkosic sands of the Wind River or of the White River formation of the Oligocene with subsequent redeposition due to the presence of some precipitation agent of hydro-carbonaceous nature. As very little carbonaceous material is found anywhere within the formation area perhaps it is true, as Eugene Grutt of the Atomic Energy Commission theorizes, that the natural gas content underlying the area provided the precipitation catalyst.

The ore occurs both in single and multiple ore horizons with the latter often as high as seven zones of varying elevations providing, as one might surmise, considerable mining problems. Both top and bottom of the majority of ore zones are undulating in character.

Radiometric equilibrium is relatively good in the deeper, unoxidized zones; however, the use of a probe unit in the oxidized areas is unreliable.

The character of the overlying material and the ore zones consisting of coarse to fine grained, loosely consolidated sands and sandy shales requiring practically no blasting makes it an ideal situation for low-cost open pit operations.

The open pit operations of the Gas Hills area range from small, 300 by 100 ft, to medium-large, 1200 by 600 ft. In fact, the Lucky Mc pits, which fall in the latter category, when completed and connected, will cover an area about 8000 ft long, 600 ft wide and will average close to 200 ft in depth.

The smaller and usually shallower (50 to 100 ft deep) pits, comprising mainly the single horizon type, are stripped by small scraper-tractor units and mined by front end loaders or ¾-yd shovels. However, Vitro Uranium Corp. has been highly successful in the use of a six-yd Marion dragline for stripping the waste from their unique strip-pit operation that is based on the open pit method of strip mining in which a 210-ft wide strip is mined out and the next succeeding parallel strip is overcast into the preceding stripped and mined area. It is well to remember that in this type of operation 30 percent of the cast material must be rehandled.

This type of operation is possible in this particular area by the ideal conditions under which it becomes practicable, such as relatively flat lying surface terrain, a flat lying orebody, a single ore horizon (multiple ore horizons would normally prohibit such a method), fairly regular ore outline, an area extensive enough for allowing long parallel cuts and an ore deposit, in Vitro's case, not exceeding 90 ft in depth.

The multiple ore horizon deposits are almost without exception stripped by scraper-tractor-shovel combinations and mined by shovel and front-end loader units.

Lucky Mc Operations Described

Although the Lucky Mc operations are not the average of the district, perhaps a brief description of its methods and procedures will serve to point up the problems to be expected by other large operations which undoubtedly will be present in the Gas Hills at an early date. Much of the present procedure has been worked out by trial and error and is applicable to all types of pit operations in the district whether large or small.

Lucky Mc classifies itself as a medium-large open pit operation inasmuch as a majority of its pits on the major trend of the ore deposit are 1200 to 1500-ft long, 600-ft wide and approximately 200-ft deep. Even though all of these pits will eventually be joined, the laws of economics demand a piece-meal development.

Exploration-Development: With few exceptions there are no ore-outcroppings in the Gas Hills area. The ore horizons lie from 50 to 400 ft below the surface, the shallower deposits being located at the northern end of the district and in general dipping four degrees southerly, following the trend of the regional structure.

In areas considered to have ore-bearing possibilities, open holes of four-in diam are drilled on 400 to 500-ft centers which are completely logged both stratigraphically and radiometrically. As ore centers are indicated the drill spacing is closed to 100-ft grids. Again, all holes are logged for stratigraphic and radiometric anomalies. Several regularly spaced holes are cored and the ore zones are chemically assayed as a control for radiometric-equilibrium. The reader will note that stress has been placed on stratigraphic logging. This information is extremely valuable in the calculation of pit perimeters and the equipment required for the final pit design.

All of the drill hole information is posted on 100-ft sections and the ore zones are connected. From these maps ore reserves and economical stripping ratios are calculated. As a sidenote, the company expects the overall stripping ratio to approach 30 to 1 on a cu yd per ton basis, with the average of the district approximating 20 to 1. This is a far cry from the old two or three to one stripping ratios formerly accepted as the limit of economical open pit mining. When it is considered that since 1934 underground costs in the copper mining industry have averaged an 18 percent increase per year, as compared to an increase of about four percent per year for open pit costs, it is obvious that open pit operations will continue to increase with economical stripping ratios governed only by the hard fact of mining the underlying ore at a profit.

Final pit design including necessary waste disposal areas is next undertaken. Starting at the bottom from the calculated areal extent of the ore deposit and proceeding upwards, safety berms, haul roads at maximum six percent grades and the maximum pit-slopes expected to be used are resolved to give a workable mining arrangement.

In this connection it has been found that despite the relatively unconsolidated type of material the pit walls will stand safely without extreme sloughing at angles of 80 degrees. Actually in the Gas Hills area there are pit walls of 90 degrees which are standing after two years of exposure.

Lucky Mc's pits are all designed for maximum 70-degree slopes with safety berms 25 to 35-ft wide placed at intervals dictated by stratigraphic conditions. Much stress is placed on drill hole logging because it would be expensive to enlarge the perimeter of a large pit in order to accommodate a safety berm not foreseen in the original design.

Mining operations are divided into three phases: pre-mine stripping, mine control drilling and ore extraction.

Pre-Mine Stripping: Pre-mine stripping can be defined as the removal of that overburden above the ore that can be moved as a separate unit, without the removal of any ore. Obviously, for the economic use of dirt moving equipment it should be removed in one continuous operation—the unit cost is less when volume is high.

In Lucky Mc's operation, consisting as it does of multiple ore horizons, pre-mine stripping could be carried on in several phases, depending upon the thickness of waste material between each ore horizon. This situation multiplies the mining problems.

Ideally, the removal of waste in the pre-mine stripping operation is carried to a plane three to five ft above the ore horizon and from there the next step of mine drilling for quality control is initiated.

Over 5,000,000 cu yd of waste has been removed from the pits to date, most of which was moved by the use of 20-yd scraper-tractors in combination with "push-cats." The harder formations which could not be ripped were removed by 2½-yd shovel-Euclid truck combinations.

Mine Control Drilling: Shallow hole drilling for quality ore control is spaced on 35-ft centers using the original 100-ft grid pattern as a base. Dust samples are collected from each foot of each hole by means of a duoclone collector (98 percent minimum recovery), sent to the laboratory, and checked with a beta-gamma scaler. All samples out of equilibrium are fluorometrically assayed. All assay and waste information is plotted on sections and a mining plan formulated. Due to the undulating character of ore horizons waste thicknesses vary from one ft to as high as 20 ft necessitating a rather complete and accurate assay plan in order to spot equipment to the best possible eco-

nomic advantage. It is sometimes necessary to split the 35-ft centers with drill holes, especially where undulation becomes quite severe. These 17½-ft centered holes are checked with geiger counter probes only.

As this type of drilling costs from 35 to 50 cents per ft not including the sampling, assaying and engineering, there is a limit to the close spaced drilling that can be economically performed. However, experience has shown that the 35-ft limit is the maximum distance to achieve optimum results and have a reasonable expectation of finding the ore and waste conditions as plotted.

Ore Extraction: The waste material lying above the ore is stripped by use of 2½-yd or 1½-yd shovels (dependent on the thickness) in combination with 15-yd Euclid dump trucks. As waste removal approaches within a foot of the ore every load of waste is radiometrically probed at a probe tower at the entrance to the pit and the loads directed either to the waste dump or the ore blending piles.

As visual control is relatively nonexistent, the company uses a probe man with each front end loader or 1½-yd shovel used in actual mining operations. Each Kenworth eight-yd truck loaded with ore stops at the entrance probe tower where the tower operator, using a three-ft probe calibrated to read direct percentages, spot checks the entire load and directs the truck operator to the appropriate blending stockpile.

Close ore control with minimum dilution is one of the major requirements of a profitable open pit operation. The additional pit-probe personnel expense to which Lucky Mc is subject has been amply repaid by the fairly accurate ore control obtained and the recovery of many tons of excellent ore occurring in isolated pods. These pods, despite the 35-ft drill control system, have a habit of "popping up," and under ordinary stripping conditions are lost in the waste pile.

Some inexperienced operators in the Gas Hills area, not realizing the undulating nature of the ore horizons and the consequent requirements for accurate ore control, have operated on the theory that waste is waste and ore is ore, and have attempted to actually mine the ore by scraper or dragline methods. The resultant ore stockpiles, too low grade for the operating mills to accept, stand as monuments to their unwise decision.

For a semi-arid climate the amount of subsurface water is truly amazing, especially in the western portion of the area. From Lucky Mc's deepest pit, now 50 ft below the water table, 200 to 300 gpm is being pumped from a main sump which is fed by a system of pumps and drain ditches. Additional water flow is expected as the other pits are opened and connected, probably not, however, in direct proportion.

By such drainage methods the ore supply is maintained at about 12 percent moisture content. However, the presence of such water in the relatively thin one to five-ft ore zones present problems which, under the sub-zero winter weather conditions common to that area, are almost economically insurmountable. For that reason mining plans call for a minimum 100,000-ton stockpile to supply the mill during the worst three months of winter.

The amount of surface rainfall would ordinarily present no problem —the difficulty lies in the fact that usually it comes all at once; consequently, a system of surface diversion canals and ditches was devised to prevent catastrophe. The diversionary system has already saved pumping several hundred million gallons of water from the main pits, not to mention the astronomical losses that would have occurred if mining plans had been delayed.

Costs: A general review of stripping and mining costs in the Gas Hills indicate a considerable divergence, dependent on the nature of the ground, topography, size of pit, depth of pit, water problems, length of haul to disposal areas and type of equipment in use.

Listed below are some of the major average cost ranges which, from the statistics the author was able to gather, apparently represent only direct operational unit costs. No explosive costs are included.

1. Exploration-Development: (optional with all companies dependent on the individual program)
   - (a) Plug hole drilling for radiometric logging — $0.50 to $1.00 per ft
   - (b) Frozen core drilling — $25. to $40. per ft
   - (c) Standard core drilling — $17.50 per ft
2. Pre-Mine Stripping:
   - (a) Dragline (including bulldozer auxiliary unit) — $0.21 to $0.25 per cu yd
   - (b) Scraper-tractor — $0.25 to $0.40 per cu yd
   - (c) Shovel and truck — $0.30 to $0.60 per cu yd
3. Ore Control: — $0.35 to $0.80 per ton
4. Mine Waste Removal: — $0.60 to $1.00 per cu yd
5. Mining:
   - (a) Front end loaders — $0.60 to $1.00 per ton
   - (b) Small shovels (5/8-yd) — $0.80 to $0.90 per ton
   - (c) Large shovels (1-1/2-yd) — $0.55 to $1.00 per ton
6. Explosives:

   Practically all operations are able to strip and mine without the use of explosives, the more compact formations being easily broken by the use of ripper-dozer combinations. At those operations requiring a small amount of blasting the cost on an overall pit should not exceed one to three cents per cu yd using ammonium nitrate prills.

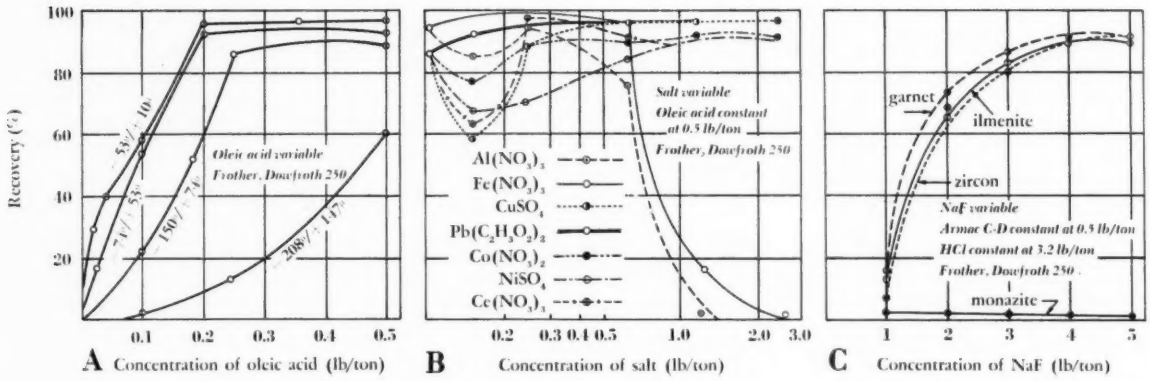


"I think I hear the Safety Engineer coming"

Although no underground mining operations for the deeper ore zones (250 to 450 ft) have been attempted as yet in the Gas Hills proper, at least one is in the formative stage and it will be interesting to note that company's approach to a mining method, ground support of unconsolidated materials, water problems and ventilation problems resulting from radon and natural gas infiltration.

To the author's knowledge no specific plans have been formulated as yet in the area for the recovery of minor offshoots of ore from the walls of the present pits.

If any reader is interested in learning more about the Gas Hills, the author can only repeat those famous words—"Come up and see me sometime!"



Monazite Flotation

The minus 200-mesh fraction of monazite placer material is not efficiently processed by jigging. Here is a report which describes successful experiments in recovery of monazite fines by flotation

By
GURCHARAN SINGH SIDHU
and
ERNEST OBERBILLIG*

FREQUENTLY a mineral is exploited for some minor impurity rather than its principal metal constituent. A few examples would include: gold in pyrite, silver in galena and beryllium in beryl. Another example is monazite. In recent years monazite has been processed for a minor component, namely thorium.

Until recently monazite also supplied commercial needs for cerium and lanthanum. At the present, however, basnasite from California appears to have supplanted monazite as a source for those metals. Monazite's future apparently centers around its minor accessory metals such as thorium, praseodymium, neodymium, erbium, europium, gadolinium, holmium, lutetium, samarium, terbium, thulium, dysprosium, ytterbium and yttrium. Jet-age metallurgy could overnight make anyone or several of the above listed rare earth elements as much a part of our daily parlance as lead or zinc. For this reason, along with the fact that Idaho has large reserves of monazite, it was considered expedient that monazite research studies be initiated.

Monazite is a placer mineral. Although vein monazite has been found in Idaho, the chief sources for this mineral are placer deposits.

Recovery of Fine Monazite By Flotation Tried

By means of placer jigs on dredges, monazite is recovered from the gravel. Jig efficiency drops rapidly for particles smaller than 200 mesh. To recover this presently lost fraction some set-up such as a stationary land-plant with Denver-Buckram tables might serve. Gravity concentration of these fine sizes would produce a concentrate consisting largely of monazite, zircon, ilmenite and garnet. Electrostatic and electromagnetic methods appear unsuitable to separate this subsieve concentrate. The problem reported here is the attempt by flotation to separate these minerals.

Essentially monazite is a phosphate of the cerium metals. Ilmenite, of course, is the oxide of iron and titanium. Garnet and zircon are silicates. Therefore, the minerals to be separated by flotation are two silicates, an oxide and a phosphate.

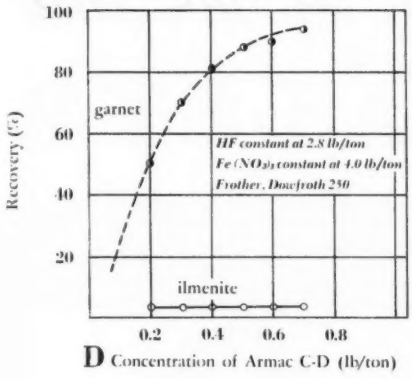
Samples of the four minerals—garnet, ilmenite, zircon, and monazite were prepared by grinding and classification to approximate the minus 200-mesh sands expected from a fine-sand gravity recovery system.

Flotation tests of 20-gram samples of these prepared minerals were made with a small, glass, pneumatic laboratory test cell.

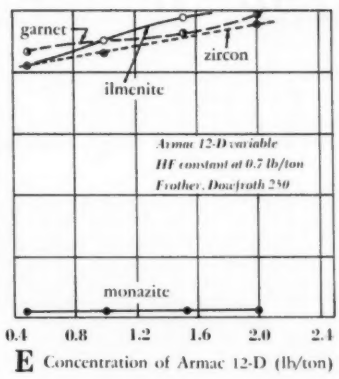
Monazite flotation was studied by testing recovery with emulsified oleic acid and various pulp modifiers and activators. A summarized conclusion of this work follows:

(1) The largest efficiently floatable particles of monazite were found to be 100-mesh (147 micron) in size. Particles 65 mesh in size were re-

* G. S. Sidhu was a recent graduate student metallurgist at the University of Idaho. This article summarizes his thesis "Flotation of Monazite."
Ernest Oberbillig was the major professor who initiated this study and is presently a consulting engineer in Boise, Idaho.



D Concentration of Armac C-D (lb/ton)



E Concentration of Armac 12-D (lb/ton)

tive collectors indicate that monazite can be separated from most silicate minerals. Preliminary tests also point out the possibility of floating thorite (thorium silicate) while leaving monazite in the non-float product.

In retrospect, monazite reacted to the various flotation reagent schemes much like it was believed that a phosphate mineral would.

This short article, corresponding to a mere abstract of the original work, is not intended to include details of all the various tests. The complete thesis is available at the University of Idaho, Moscow, Idaho.

coverable to an extent of only 60 percent. Graph A shows this.

(2) Acid and base pH modifiers were all depressants with oleic acid as the collector. Sodium carbonate in moderate quantities, however, decreased recovery only slightly. Sulphuric and phosphoric acids along with caustic soda, even in small quantities, were powerful depressants.

(3) Calgon was found to be an extremely powerful depressant; sodium silicate was next in order, with tannic acid appearing to be the least depressive.

(4) Several metallic salts showed a peculiar "dip" in the recovery curve as shown in graph B. Lead acetate exhibited strong activator qualities at all concentrations up to three pounds per ton.

This series of flotation tests of monazite with oleic acid demonstrated the commercial possibility of recovery by flotation.

Separation From Accessory Minerals Feasible

The use of positive (silicate floater) reagents was indicated for the flotation of zircon and garnet and their possible separation from monazite. Armac CD, as shown in graph C, appears to have effected a separation of the silicate minerals from monazite. This is a reversal of the usual technique; here the monazite was left in the non-float "tailing". While both sodium fluoride and hydrochloric acid were used, later tests showed hydrofluoric acid alone was sufficient for the same result.

A separation of garnet and ilmenite appeared feasible using Armac CD and ferric nitrate as depicted by graph D.

Graph E shows the separation of monazite from zircon, illmenite and garnet when varying the Armac 12-D (collector) concentration.

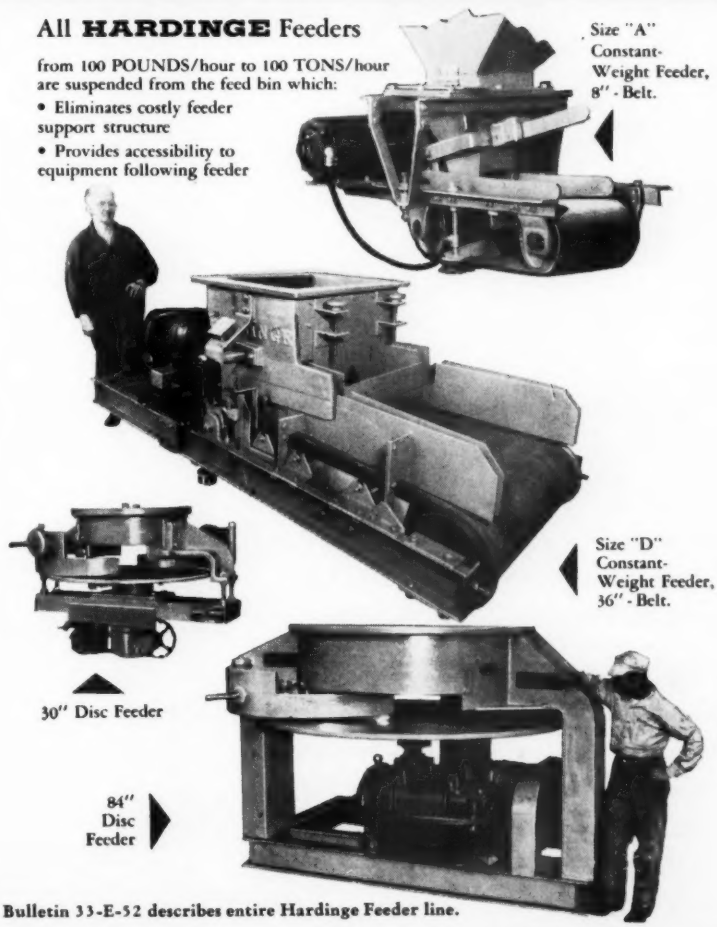
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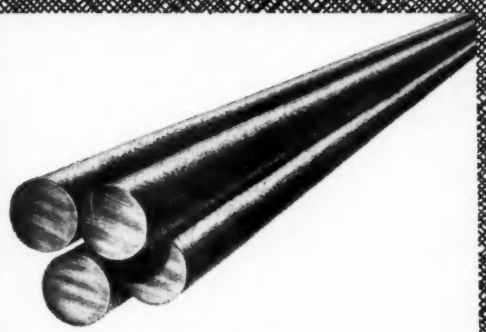
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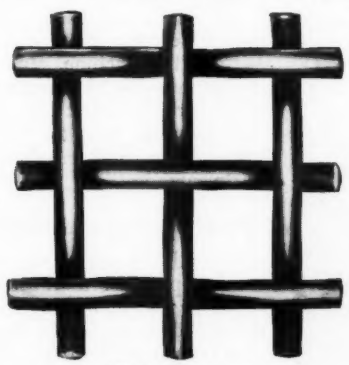
mining industry

STEEL PRODUCTS



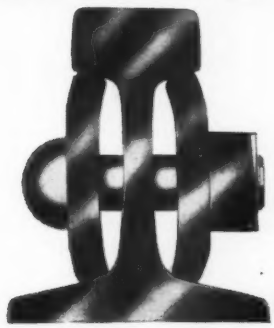
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Operators' Corner

DON'T WASTE IDLE HOURS*

TODAY'S heavy earthmoving machinery and industrial engines are built to work hard over a period of many thousand hours. Unlike human beings and animals, they require no rest. However, due to seasonal lulls or waits between jobs, all machines periodically may be idle for indefinite periods of time. These idle hours need not be lost; they *can* mean future savings in both time and money.

When a machine is shut down for a long period, the measure of its life —the service meter—remains still. The time the machine remains idle can be made to work for the owner if it is properly prepared for storage. Here are some suggestions on how this can be accomplished for two to six-month storage periods.

Diesel Engines and Starting Engines

Internal surfaces of the engines should be kept coated with oil either by periodically operating the engines, or by spraying with a preservative oil. Regular attention to this matter is particularly important when the parts involved have machined surfaces. Oil tends to drain from these smooth surfaces more readily than from rougher surfaces.

Fuel tanks of both the gasoline starting engine and the diesel engine should be protected. The starting engine tank should be filled completely with gasoline containing a gum stabilizing additive. The diesel tank should be filled with fuel to which enough preservative lubricating oil has been added to achieve a three percent mixture.

Track-Type Tractors, Pipelayers, Front-End Loaders

The cork-rubber sealing surfaces on the final drive seal assemblies may stick to the wear washers on track-type tractors, pipelayers or front-end loaders which are allowed to stand for lengthy periods. Should this occur, the seals will, in all probability, be damaged and cause leakage when the machine is again operated. To prevent this, the machine should be driven forward and backward occasionally during the storage period.

Usually the most convenient time to accomplish this is when the engine has been started to renew the oil film on the cylinder walls and piston rings, which should be done at least once every 30 days.

At the same time the oil film should be renewed on all the moving parts of the machine. This can be accomplished best by driving the machine for a sufficient time in all gears to thoroughly circulate the oil in the transmission and final drive compartments.

Wheel Tractors and Motor Graders

The oil film can be renewed on the moving parts of a wheel tractor or motor grader by driving the machine a short distance at the time the engine is operated to renew the oil film on the cylinder walls and piston rings. When a machine has been placed on blocks for storage purposes, the same results can be accomplished by shifting the transmission into all gears while the engine is running.

In neither of these cases is it necessary to operate the machine until the transmission oil becomes warm. However, ample running time should be allowed so the oil will be circulated thoroughly over all moving parts.

If you make sure the hours your machine is idle are "banked", you will receive "interest" in the form of availability and longer service life.



Maintenance of operating equipment is of prime importance, but proper care of a machine during idle periods can also pay dividends in the form of availability and longer service life

* Courtesy of Caterpillar Tractor Co.



As Viewed by HARRY L. MOFFETT of the American Mining Congress

Partially as the result of lower tax revenues in the wake of last year's business recession, the Government went into the red $12.5 billion in the fiscal year ended June 30, according to Treasury Department figures. The prospect for the current year is much brighter, for six-month earnings reports of many corporations have shown marked improvement and in some cases reached new highs.

Another encouraging budgetary factor was a Department of Commerce announcement last month that rising wage and salary payments pushed the personal income of Americans in June to a record rate of $382 billion a year.

In Congress, meanwhile, the "spenders" have been held under some measure of control by their more conservative colleagues, particularly in the majority party, in order to counter "budget busting" charges by the Administration.

COMMITTEE APPROVES MINING AID RESOLUTION

The House Interior Committee has approved and sent to the House floor a resolution which, if adopted by the House and Senate, would request the President to review Government minerals policies and report promptly to Congress on steps he proposes to aid depressed branches of the mining industry.

Committee endorsement came at the conclusion of six days of voluminous hearings during which scores of witnesses described current conditions in many mining areas. Congress is expected to approve the resolution, which merely expresses the desire of Congress and does not have the effect of law.

The President may ignore the request, for Congress has twice refused in the past two years to enact Administration-supported legislative proposals for relief of hard-hit segments of the industry. Interior Secretary Fred Seaton, whose minerals stabilization plan was rejected by the House last summer, has made it clear that it is up to Congress to initiate any minerals program this year.

Opening witnesses at the hearings were Committee members and other Congressmen from mining areas. Julian Conover, executive vice president, American Mining Congress, presented a general statement giving over-all views on national policies affecting the mining industry. He noted that a major cause of present difficult conditions in various branches of the industry is world overproduction and excessive imports into this country.

Remainder of the hearings was devoted to other industry spokesmen who covered the current situation and problems of particular metals and minerals, including lead, zinc, gold, silver, cobalt, chrome, manganese, mercury, antimony, tungsten, rare earths, fluorspar, bituminous coal, and anthracite.

Several witnesses were questioned by Committee members as to the type of Government action needed to insure a healthy domestic mining industry. Replies indicated a preference for tariffs as the soundest and longest-range solution; quotas and direct subsidies received some support.

Washington Highlights

MINERAL POLICIES: Presidential review sought.

LABOR REFORM: Bill ready for House.

TVA: Congress approves bond bill.

COAL RESEARCH: Senate may act.

WILDERNESS SYSTEM: Endorsed by Administration.

COAL SAFETY: Hearings held on small mines.

AIR POLLUTION: Bills studied.

MINIMUM WAGE: Extension considered.

MANGANESE: Purchase program ends.

LABOR BILL READY FOR HOUSE VOTE

After weeks of closed-door drafting sessions, the House Labor Committee completed action late last month on a watered-down version of the Kennedy union reform bill passed in April by the Senate.

As revised by the Committee, it is a softer measure to require regular financial reports by unions, establish uniform rights of members to speak, vote and run for office, and give union members the right to seek court enforcement of these rights after they have exhausted internal union procedures. It also contains some Taft-Hartley Act revisions sought by unions, as well as provisions to restrict "hot cargo" practices—holding up goods coming from or going to an "unfair" employer—and prohibit picketing for extortion purposes.

While proponents of effective labor reform legislation had insufficient power in the Labor Committee to be effective, they may force adoption of much-needed strengthening provisions during House debate on the measure.

Some time may elapse before any labor reform bill becomes law, for the Senate and House will have to iron out differences between the Senate version and any bill which may finally be approved by the House.

TVA BONDING AUTHORIZATION ENACTED

The House has concurred in Senate amendments to a bill which would give the Tennessee Valley Authority the right to issue bonds to provide for future power expansion, and the

measure is awaiting Presidential action.

Inasmuch as it does not meet with Administration views on a number of points, there are some predictions that President Eisenhower may veto it.

The House version would have permitted TVA to issue revenue bonds without any budgetary controls, but would have prohibited the agency from expanding its marketing area beyond present limits, with minor exceptions.

The final version is somewhat more liberal with regard to new power service areas of TVA, permitting it to expand five miles beyond the periphery of its present area. In addition, there is no limitation whatever upon the transmission, resale or use of TVA power outside the agency's existing service area so long as such transmission, resale or use is by its distributors (municipalities, cooperatives, etc.) under existing contracts, and not by TVA itself.

As enacted, the bill would permit TVA to issue revenue bonds up to a maximum of $750 million, subject to approval by the Secretary of the Treasury as to time of issuance and interest rate. If approval should be withheld for eight months, TVA could issue the bonds anyway. Provision is made for repayment of the Government's appropriation investment in TVA.

COAL RESEARCH BILL READIED FOR SENATE

An amended version of a House-passed bill to establish an independent Coal Research and Development Commission has been approved by the Senate Interior Committee.

As passed by the House, the measure would set up a three-man Commission as an independent agency of the Government to supervise a five-year program of coal research and development, with $2 million authorized for the first year. This approach was endorsed by coal-industry spokesmen, including the American Mining Congress.

At Senate hearings in June, however, Administration witnesses and the United Mine Workers urged that the research program be placed under the jurisdiction of the Bureau of Mines.

In an apparent attempt to reconcile these divergent views, the Senate Interior Committee adopted an amendment which would place the Commission in the Department of the Interior, but keep its work separate from the basic coal research currently being conducted by the Bureau of Mines.

Another measure under consideration by the Senate Interior Committee would provide for the establishment of a nuclear energy-coal experiment station in the coal regions of eastern Kentucky, for the purpose of finding ways of liquefying or gasifying coal through atomic bombardment. The Bureau of Mines testified in support of the bill's objectives, but suggested that such a program could be carried out more efficiently by enlarging existing research stations.

AGENCIES ENDORSE WILDERNESS PRINCIPLE

Pending legislation to establish a National Wilderness Preservation System has been endorsed, with minor reservations, by the Government's major land-management agencies—the Departments of Interior and Agriculture.

Their views were made known in reports to the Senate Interior Committee, which has jurisdiction over the so-called Wilderness bill introduced earlier this year by 17 Senators. The measure would set aside an estimated 50 million acres of national parks, monuments, forests, and other land areas for the virtually exclusive use of outdoor enthusiasts.

The American Mining Congress and other spokesmen for natural-resource industries have consistently opposed such legislation on the grounds that by prohibiting, for all practical purposes, mining, lumbering, and grazing, it would tend to stifle economic development of the Western States.

Although the Departments' endorsement increased the bill's chances of enactment, the Senate Interior Committee—which has held several hearings on Wilderness bills in past years—has not decided whether to report the measure to the Senate for a vote.

FEDERAL INSPECTION OF SMALL COAL MINES

A Senate Labor subcommittee held hearings late last month on legislation which would place coal mines employing fewer than 15 persons generally under the provisions of the Federal Coal Mine Safety Act, which has governed operation of all other coal mines since 1952. The subcommittee was expected to pass the bill on to the full Committee with a favorable recommendation.

Last year the Committee approved a similar bill, but it did not reach the Senate floor for a vote.

Another measure pending in the Labor Committee would require Federal health and safety inspections of noncoal mines. Although the bill was introduced early this year, no action has been taken on it.

AIR POLLUTION HEARINGS

The House Commerce Subcommittee on Health and Safety has concluded hearings but has not acted on several bills which would extend the Air Pollution Control Act, including a Senate-approved measure.

The Senate bill extends the present five-year law for an additional four years and increases the authorization for annual appropriations for air pollution research from $5 million to $7.5 million.

Arthur S. Flemming, Secretary of Health, Education and Welfare, testified in general support of the measure, but wanted it amended so that he would have authority to hold public hearings on the causes of air pollution.

Meanwhile, the Senate has not acted on a House-passed bill to double Federal aid for water pollution control projects.

WAGE-HOUR BILL STUDIED

The Senate Labor Committee is considering a bill which would extend coverage and generally increase the minimum hourly wage and overtime provisions of the Fair Labor Standards Act. Recently reported to the full Committee by a subcommittee, the measure would extend the minimum wage coverage to an estimated 10 million additional employees, and, with specified exceptions, increase the minimum wage to $1.25 per hour over a three-year period.

MANGANESE PURCHASE PROGRAM ENDS

The Government's domestic manganese carload purchase program, initiated when the Korean war stepped up the Nation's metal requirements, was terminated August 5. On that date the program's goal of 28 million long-ton units of contained manganese was achieved.

Earlier, Senator Murray (Dem., Mont.) urged the Senate Appropriations Committee to approve $23 million for the purchase of 10 million units, which he said would continue the program through 1960. "If this appropriation is not granted," Murray said, "the manganese industry will follow tungsten, chrome and other segments of our domestic mining industry down the drain."

personals



Horace M. Albright, business leader, formerly director of the National Park Service, and one of the Nation's leading conservationists will be honored with a Testimonial Dinner in Washington, D. C., December 4. In addition, a lectureship on conservation will be created in honor of Albright at the University of California.

Following the recent acquisition by National Gypsum Co. of Huron Portland Cement Co., National Gypsum has announced a reorganization in Huron's management personnel. **Paul H. Townsend** continues as president and chief executive officer. He will also serve as Huron's board chairman and has been named a director of National Gypsum, the parent organization. **H. Ripley Schemm,** who has been vice president in charge of operations at Huron, has been named executive vice president. Schemm is also a member of Huron's board of directors.

The Lorado Coal Mining Co. has announced that on July 6 **C. W. Thompson** became general superintendent of its West Virginia operations at Lorado, W. Va.

Important changes in the top management structure of four of the principal companies in the Kaiser industrial group have been announced. The following men have been elected president and chief executive officers of their companies: **J. L. Ashby,** Kaiser Steel Corp.; **W. A. Marsh,** Permanente Cement Co.; **D. A. Rhoades,** Kaiser Aluminum & Chemical Corp.; and **S. A. Girard,** Willys Motors, Inc. Each of the men formerly served as vice president and general manager of their respective organizations.

Henry J. Kaiser, Sr., formerly chairman of the board and president of the four companies has assumed the new position of founder-chairman of each organization. **Edgar F. Kaiser,** formerly vice president of aluminum, steel and cement, and president of Willys Motors, became chairman of the board of each organization.

The National Coal Association recently elected **F. Stillman Elfred,** board chairman of Peabody Coal Co., of St. Louis, to head its board of directors. R. L. Ireland, chairman of executive committee, Consolidation Coal Co., was chosen vice chairman, and George E. Enos, president of Enos Coal Mining Co., was re-elected treasurer.

Hans Stauffer, president and director of Stauffer Chemical Co., has been appointed to the board of directors of the American Smelting & Refining Co. He replaces **James S. Rockefeller,** resigned.

Barton R. Gebhart was recently elected a director of Freeman Coal Mining Corp. Gebhart has been vice president of Freeman, in charge of sales and distribution, since 1955, when Freeman took over sales of coal from the mines of Chicago, Wilmington & Franklin Coal Co. He was formerly vice president and a director of that company.

W. T. Maguire has resigned as mining engineer with the Atomic Energy Commission at Spokane to join J. R. Simplot Co. He has been succeeded by **Harlan Holen.**

Walter C. Russell has been elected president of American Cement Corp., a post vacated by the recent death of D. S. MacBride. Russell, who is also vice chairman of the board and chairman of the executive committee, was president of Peerless Cement Corp. before its 1957 merger with Riverside Cement Co. and Hercules Cement Corp. to form American.

Glen Alden Corp. has announced the appointment of **Harold A. Ketchum** as executive assistant to the president, and **Rocco J. DiFonso** as treasurer of Glen Alden and its subsidiaries. Ketchum for the past three years was with the Federal Pacific Electric Co. of Newark, N. J., as vice president—finance. DiFonso formerly was controller and assistant treasurer of H. K. Porter Co. where he played an active part in that company's merger and acquisition program.

Robert E. White has been named safety supervisor at the Southwest Potash Corp. mine, Carlsbad, N. M. Mr. White had been serving as a section foreman since 1956.

W. J. Neely of Rock Hill, S. C., has been elected to the board of directors of Holmes Darst Coal Corp. Neely, a vice president of the company for several years, has been with Holmes Darst since 1941.

Roger M. Claywood has been named superintendent of mines in the Ambrosia Lake area for Phillips Petroleum Co.

NEW ASSISTANT EDITOR JOINS AMC STAFF

David W. Pinkard is a new assistant editor of Mining Congress Journal. A mining engineering graduate of the University of Idaho, "Dave" comes to the Journal with a wide range of experience.



He started his mining career during student days as an underground laborer for Howe Sound Co., and picked up more practical mining and engineering know-how on jobs with Anaconda and Bunker Hill. Following graduation he joined Allis-Chalmers Mfg. Co. where he was a graduate training engineer in several departments concerned with the manufacture of mining and milling equipment. Dave left A-C to join American Smelting and Refining Company's metallurgical staff at the El Paso smelter where he gained knowledge in nonferrous smelting operations. A year ago he joined Joy Mfg. Co. as office manager at the company's El Paso District office, which supplies the southwest area with mining, construction and industrial equipment.

We are glad to have Dave on the MCJ staff and are sure that his varied background in mining, metallurgy and manufacturing will be of great value to the Journal and its readers.

Dave replaces Jerry M. Whiting, who has resigned to become assistant professor of mining engineering at the University of Idaho's College of Mines in Moscow, Idaho.

Several personnel changes have been announced by New Jersey Zinc Co.

William T. Pettijohn has been appointed manager of mines, with headquarters at New York. **Johnson Crawford** and **A. L. Hayes** will be assistant managers, with headquarters at Jefferson City, Tenn., and Grand Junction, Colo., respectively.



W. T. Pettijohn

Pettijohn joined New Jersey Zinc in 1948. Since 1957 he has been assistant to the vice president in charge of mining and exploration.



A. L. Hayes



J. Crawford

Crawford came with the company in 1945 and most recently has been superintendent of operations in Tennessee. He will now direct all company activities in the Tennessee area.

Hayes, a veteran of over 30 years service with New Jersey Zinc, was recently made president of the Tex-Zinc Minerals Corp., a jointly-owned subsidiary of Texaco, Inc. and the New Jersey Zinc Co. He now has been recalled to the service of the parent company where he will have charge of the company's Western mining operations, and will serve as technical consultant on milling methods and procedures at all the company's milling operations.

Other organizational changes include: appointment of **K. R. Winslow** to superintendent of the Hanover, N. M., operations; naming of **A. D. Hoagland** as chief geologist, Tennessee; promotion of **Clark H. McNaughton, Jr.** to mine chief at Austinville, Va.; naming of **B. J. O'Neill** as assistant mine chief at Treadway, Tenn., and the appointment of **W. T. Forsyth** as resident geologist for Pennsylvania.

John N. Crichton has been elected executive vice president of Johnstown Coal & Coke Co. He succeeds **C. N. Crichton,** who has been elected chairman of the company's executive committee.

The Maine Geological Survey has announced the appointment of **Robert G. Doyle** as its new State geologist, replacing **John R. Rand,** who has opened a private consulting office.

Before joining the Survey as assistant to the State geologist last July, Doyle had been a staff geologist with the St. Joseph Lead Co. in southeast Missouri.

Ward E. Bowman, head of the public relations department of Kennecott Copper Corp., Chino Mines Division, from 1948 to 1954, has been named director of public relations at the company's Utah Copper Division. He succeeds **Nelson W. Aldrich,** who has opened a public relations and management consulting firm in Salt Lake City. Since 1954 Bowman has been located in New York as assistant to the director of industrial public relations for Kennecott.

The retirement of **Henry C. Schmielau** as vice president and comptroller of Universal Atlas Cement Division of U. S. Steel Corp., has been announced. **Charles A. Headlee** succeeds Schmielau in the responsibilities of comptroller.

Ira D. Beynon has resigned as special assistant for General Services Administration overseeing the Government's interest in the Nicaro Nickel Project. His duties have been taken over by **Harold Holtz,** Commissioner of the Defense Materials Service.

The election of **Neill K. Banks** as president of Texas-Zinc Minerals Corp. has been announced. Texas-Zinc Minerals is a uranium company jointly owned by Texaco Inc. and the New Jersey Zinc Co.



Formerly an engineer at the Austinville, Va., mine and superintendent of the Depue, Ill., smelting plant of the New Jersey Zinc Co., Banks joined Texas-Zinc in 1957. He was named vice president in February 1959.

Tom E. Howard, assistant chief of the Bureau of Mines, Spokane field office, has been promoted to chief of the branch of ceramic and fertilizer materials in Washington, D. C. Howard is a graduate of Colorado School of Mines.

John M. Hoffman has been elevated to the newly-created position of mining manager of the Anaconda Co. He has been assistant to the vice president in charge of operations since 1958.



J. H. Hoffman

Hoffman joined Anaconda in 1940 as a sampler and engineer at the Walker Mine in California. In 1941 he was transferred to the company's subsidiary, Andes Copper Mining Co., where he rose through various mining supervisory positions to become mine superintendent in 1954. In 1957 he was made assistant to the manager and the following year was transferred to New York and became assistant to the vice president in charge of operations.

Anaconda also announced the naming of **Martin H. Hannifan** as manager of mines at Butte, Mont. He had been assistant general superintendent of mines and in charge of the company's Kelley mine.

OBITUARIES

L. W. Householder, 75, former president of Whiteman & Co., and a past official of Rochester & Pittsburgh Coal Co., Indiana, Pa., died July 12. Mr. Householder for many years was a member of the wage scale committee of the Central Pennsylvania Coal Producers Association.

Malcolm Brus Kildale, 60, chief geologist for International Smelting & Refining Co., passed away June 13 in Salt Lake City.

Robert Barnwell Fuller, Sr., 67, former general manager of International Minerals & Chemical Corp., died June 3, in Lakeland, Fla.

Gilbert S. McClintock, vice chairman of the board, Glen Alden Corp., died in Wilkes-Barre, Pa., June 18, following a heart attack.

A lawyer, Mr. McClintock was a long-time director of Glen Alden and, when List Industries earlier this year merged with Glen Alden, he was named vice chairman.

NEWS and views



Method for Testing Sealed Areas of Coal Mines

Development by U. S. Bureau of Mines researchers of a new technique that can speed safe rehabilitation of coal mine workings following fires has been announced by the Department of Interior.

The new method employs a series of diagrams that can be used to determine whether an area that has been sealed in efforts to extinguish a coal-mine fire can be reopened safely. With the diagrams, the "explosion potential" of the atmosphere in a sealed area can be calculated in approximately one minute, after its composition has been determined by chemical analysis. Although various other methods are used to weigh this hazard, they require greater technical knowledge, are more time consuming, and usually are impractical in the field, according to the Bureau.

This method is reliable when applid to any coal mine atmosphere in which the hydrogen and carbon monoxide contents do not exceed five percent and three percent, respectively. If either is above these limits, a more detailed procedure must be employed. However, the Bureau said studies of many mine fires showed that these limits seldom are exceeded and that the method would be applicable in more than 90 percent of the cases.

A copy of Information Circular 7901, "Determining the Explosibility of Mine Atmospheres," by M. G. Zabetakis, R. W. Stahl and H. A. Watson, can be obtained from the Bureau of Mines, Publications-Distribution Section, 4800 Forbes Ave., Pittsburgh 13, Pa.

Michigan Chemical Unit Moved to Michigan

The Minerals Exploration unit at Golden, Colo., of Michigan Chemical Corporation's Rare Earth and Thorium Division, is being moved to the Saint Louis, Mich., headquarters. This will facilitate closer relationship between field and ore-concentration activities and the analytical and chemical research functions at the company's rare earths plant. The Silver Spruce Mill at Idaho Springs, Colo., which has been equipped for testing and concentration of rare earth ores, is to be retained.

Michigan Chemical will continue its examinations of amenable deposits of the yttrium rare earths. Judson H. Whitman, the corporation's mining engineer, reports that geological and engineering services will be available in the West, as usual, in connection with the examination of properties which appear to be of merit.

Rescue Operations Successful at Kentucky Mine

Three coal miners were rescued May 31 from Peabody Coal Company's Ken mine at Beaver Dam, Ky. The men, who were working in the face of a "punch" mine, had been trapped for over 41 hours by a large roof fall. Air and milk were supplied to them through a water spray line which rode down with the fall and remained intact.

Rescue operations were carried on with a Colmol borrowed from the Colonial Coal Mining Co. at Madisonville, Ky., about 60 miles away. The rescue machine had just been overhauled and was being readied for its return underground when the rescue call came.

Six Winners Named in National Safety Competition

Six mines and quarries in Illinois, Michigan, Minnesota, Pennsylvania and West Virginia were recently announced by the Department of the Interior as winners in the largest National Safety Competition ever sponsored by the Bureau of Mines. A record total of 675 mineral operations in 44 states made the 1958 competition the most successful in history, according to Marling J. Ankeny, Bureau director. He noted that 272 of the mines and quarries participating last year reported no disabling injuries, equaling the record established during the 1957 contest. These injury-free operations amassed over 25,000,000 man-hours of worktime during the year, he added.

Selected on the basis of records submitted to the Bureau of Mines, the winners are: Bituminous coal mines (underground)—No. 14 mine, U. S. Steel Corp., Gary, W. Va.; metal mines (underground)—Pioneer mine, Oliver Iron Mining Division of U. S. Steel Corp., Ely, Minn.; nonmetallic mines (underground)—Grand Rapids mine, Bestwall Gypsum Co., Grand Rapids, Mich.; open pit mines—Erie Commercial Mining Pit, Erie Mining Co., (Pickands Mather & Co.), Hoyt Lakes, Minn.; quarries—Thornton quarry, Material Service Corp., Thornton, Ill.; anthracite mines (underground) — Germantown colliery, Raven Run Coal Co., Centralia, Pa.

Any mine or quarry in the continental United States is eligible to enter the National Safety Competition. Contest rules and applications can be obtained from the Branch of Accident Analysis, Division of Safety, U. S. Bureau of Mines, Washington 25, D. C.

Strip-Mined Lands Replanted

About 2473 acres of land disturbed by coal strip mining have been planted this year by members of the Kentucky Reclamation Association. The project was carried out according to plans prepared by each coal company and approved by the director of the Kentucky Division of Strip Mining and Reclamation. Since the association was formed in 1948, a total of 7,472,548 trees and game-food plants and 191,141 lb of forage seed have been planted and sown on strip-mined lands.



E. M. Cassidy, superintendent of Snow Hill Coal Corp., Terre Haute, Indiana, is the winner of the Le Roi "bit guessing contest" held during the 1959 AMC Coal Show at Cleveland.

Mr. Cassidy topped more than 5,500 entries with his winning guess of 21,775 Newmatic® bits. The actual count was 21,761.

So, happy grilling, Mr. Cassidy! And to the others — thanks for participating and better luck next time.

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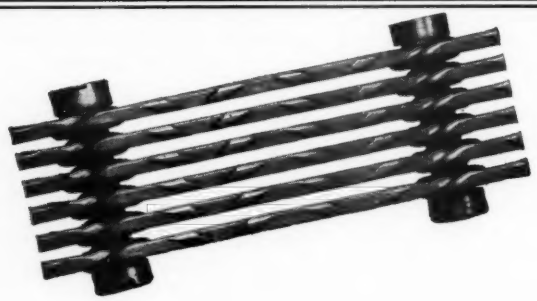
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Material Service and General Dynamics May Merge

The boards of General Dynamics Corp. and Material Service Corp. recently announced approval of the merger of their respective companies. The proposal provides that General Dynamics' acquisition of Material Service will be financed through an exchange of stock. Shareholders of both corporations will be asked to approve the merger at special meetings.

One of the nation's largest producers of building materials, concrete products and coal, Material Service of Chicago, Ill., will become a major division of General Dynamics. Henry Crown, present chairman of the board of Material Service, will continue as chairman of the new division. Frank Nugent will remain president of Material Service's Freeman Coal Mining Corp., which operates several coal mines in Illinois, and Lester Crown will continue as president of Marblehead Lime Co.

According to Frank Pace, Jr., board chairman of Dynamics, the merger of these two organizations, one primarily in defense, the other entirely in commercial business, offers vital advantages of long term growth and development for both.

Zinc Production Curtailed

At American Zinc, Lead & Smelting Company's annual meeting, Howard I. Young, president, told stockholders that the results of the recent zinc-lead meeting under the auspices of the United Nations indicate that foreign producers of zinc are making reductions in their production to bring supply in line with consumption. With this move, and a further reduction in domestic production, it is reasonable to expect some improvement in the price of zinc and lead after the outlook in the steel industry has been clarified. Young also stated that the operation of the new Coy Mine at Mascot, Tenn., which was brought into production in January of this year, was coming up to expectations and that the operation is on a profitable basis.

Installment Sales of Mining Equipment

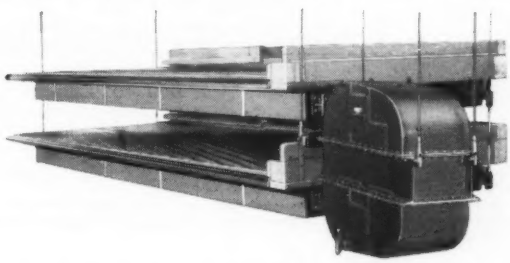
A new plan has been announced which will enable mining equipment manufacturers to set up full programs for installment sales of their income-producing equipment, obtain complete financing, and have the financing company handle all the customer credit, collection and paper work at no extra charge. The plan was released by Arthur F. Silbert, vice president of Standard Financial Corp., 530 Fifth Ave., New York 36, N. Y.

This program is available to manufacturers of income-producing mining equipment in connection with their installment sales to trade customers. The financing company will furnish such manufacturers with the necessary contracts, credit applications and notes, will check customer credits anywhere in the country within three days, and assume the chore of collection.

Equipment purchasers would be required to make only a down payment of 15 percent in cash or trade, the balance payable in one to five years.

ALSO . . .

G. A. Shoemaker, executive vice president of Consolidation Coal Co., has been elected to his ninth consecutive term as president of Western Pennsylvania Coal Operators Assn.



Twice as Much Washed Coal in the Same Plant Area

That's exactly what happens when you install a CONCENCO® "77" Table with suspended twin decks. This high producing table occupies no more plant space than was formerly required for the floor-mounted single deck table. Each of the two decks, however, has exactly the same capacity, efficiency and characteristics as the single deck of the still famous forerunner SuperDuty® table . . . but the "77" decks operate from one synchronized head motion in a floating suspension that substantially reduces impact to the building. This, in turn, makes it possible to use lighter construction for any preparation extensions or new plants.

If you have not already studied all the advantages of the new CONCENCO "77" Table, it will pay you to do so.* Send today for Bulletin 77 and full information.

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Where its use may be indicated, the SuperDuty DIAGONAL - DECK® Table continues to offer highly efficient and economical preparation of fine sizes.* For full information, simply ask for Bulletin 119.

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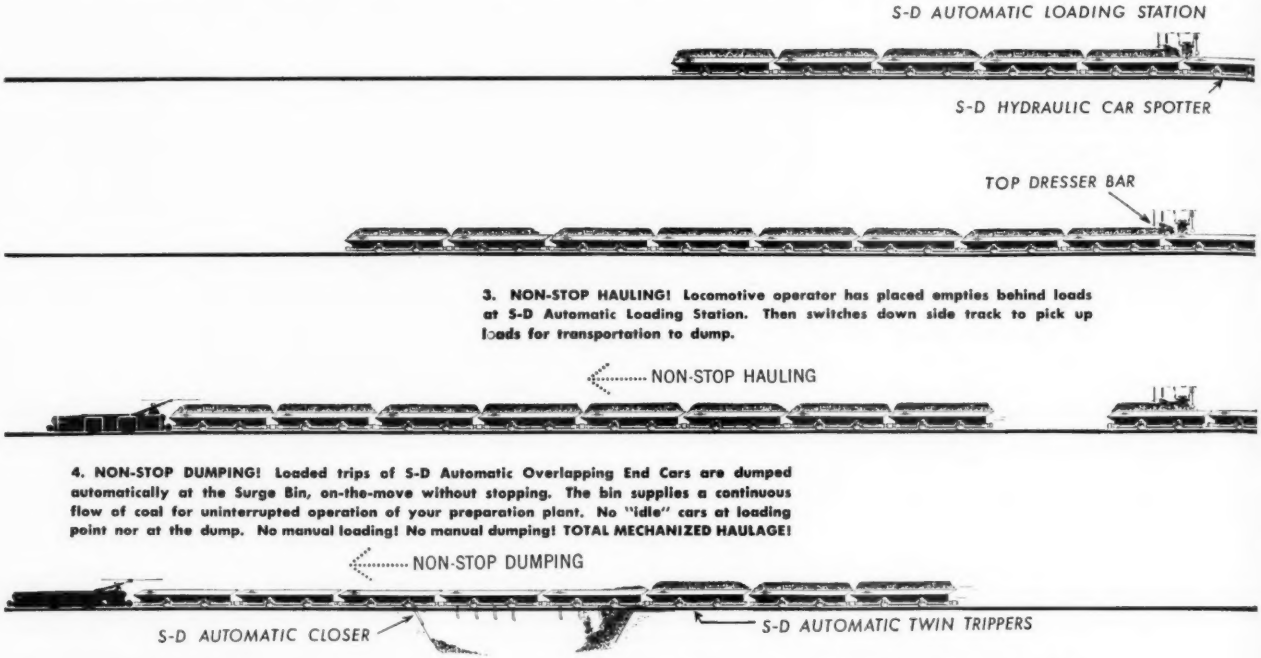
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YOU CAN NOW STOP BUYING MINE CARS . . . and START BUYING A HAULAGE SYSTEM that:

(1) provides a constant carrier for your continuous mining efforts to haul the coal away just as fast as it is mined . . .

(2) keeps a constant supply of coal available in Surge Bin for continuous and uninterrupted operation of your preparation plant . . .

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(4) requires low initial capital investment and operates at low cost per ton of production.



As you have already noted in illustration above, it makes no difference whether an S-D Automatic Overlapping End Car is in trip enroute to or from the dump . . . or in a trip being loaded . . . or in trip rolling across the dump to be emptied (and it has to be at one of those places AT ALL TIMES) — the car and the trip it is in are constantly and continuously AT WORK!

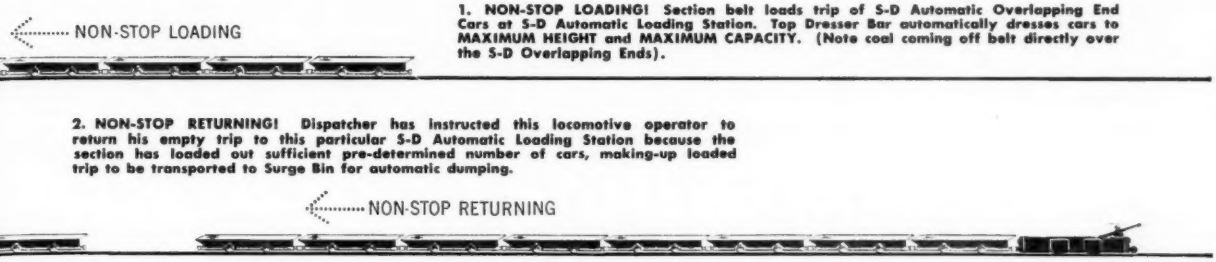
Here is what happened in actual loading of mine cars before our engineers developed the S-D Overlapping End Car, which provided practical and effective application of Automatic Loading Stations. Conventional cars were loaded in series of uneven "heaps" or surcharges, some of which were higher than roofing limitations — causing spillage and further, not providing level-width across top of surcharges to natural angle of repose for maximum loads, and also resulting in a hill-and-valley partial load.



NOW, since the development of the S-D Automatic Overlapping End Car, mine operators are installing a simple cross-bar or U-shaped-bar equal in height above rail to their minimum haulageway roof clearance. This is installed just beyond belt-head. The limit switch controls at the automatic loading station are set to permit each car to be loaded higher than haulageway clearance. Then, the Top Dresser Bar, as it is called, scrapes off the surplus, spreading the material sideward and also leveling the "humps" as loaded car moves under it. When end of car (and there may be some question whether S-D Overlapping End Cars have ends) is moved under this Dresser Bar, the surplus coal is plowed over the S-D Overlapping Ends into next car coming under belt to be loaded. Consider this for a moment. The only practical method to obtain a MAXIMUM LOAD is to load the car high and scrape surplus from one car to another — and this is done automatically! Movement of car-trips at these Automatic Loading Stations is accomplished by Sanford-Day Hydraulic Car Spotters or Sanford-Day "Brownie" Hoists. On a 10-ton S-D Overlapping End Car, for example, users report that Top Dressing permits them to load another ½ to 1 ton. This PLUS an additional ½ to 1 ton

every 6th car in a trip!

Gather round, gentlemen! Here is also NON-STOP MAXIMUM HAULAGE!



more payload obtained by the S-D Overlapping Ends themselves! SAVINGS? At one mine 250 S-D Automatic Overlapping End Cars are doing the work that previously required 293 of the same cars without Overlapping Ends. They eliminated every 6th car in a trip! How much tonnage are those 250 cars hauling? Four thousand tons per shift — 12,000 tons a day! (Maximum haul one way is six miles, minimum is three.) What happened to the tonnage carried by the other 43 cars? The S-D Overlapping Ends and their ability to assure MAXIMUM LOADING are now handling their loads! How much did the changeover save them? Approximately $250,000.00 annually! Due, in the main, to S-D Overlapping End Cars eliminating manpower at the loading stations.



Reason this direct comparison can be made is because this customer converted their conventional S-D Automatics by having us produce S-D Overlapping End "sections," which were installed on their cars at the mine. Only bottom dumping mine cars can have Overlapping Ends. You, too, can convert your present bottom dumping cars, height of car and curve radii permitting. If you are not using bottom dumping mine cars, you have the greatest opportunity in the history of mining to drastically reduce your haulage costs, an opportunity that deserves your immediate and serious consideration.

This Sanford-Day NON-STOP MAXIMUM HAULAGE system is in operation daily at several mines — some large, some small. To see any one of them will surely convince you. Would you like to know where they are? If not convenient to actually see one right away, call us and we will show you documentary filmed report or we will mail film to you so you can see and study at your convenience this NON-STOP MAXIMUM HAULAGE system in actual mine operations. You don't want to order another mine car, regardless of design, until you do. Write or call us today!



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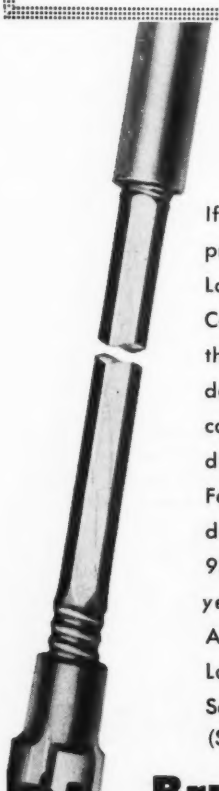
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Oliver Iron Mining Division's Soudan mine held open house, July 18, during a three-day Diamond Jubilee Celebration, July 17, 18 and 19, at Tower-Soudan to commemorate the 75th Anniversary of the first shipment of iron ore in Minnesota. Discovery of iron ore at Soudan, on the Vermilion range, marked the beginning of an industry which has been a major factor in the growth and development of Minnesota. The Soudan mine, which still produces high grade ore, was originally developed by Minnesota Iron Co., a predecessor of U. S. Steel's Oliver Iron Mining Division. The Soudan shipped its first ore to Two Harbors on July 31, 1884, and has made shipments every year since 1904.

Haines & Lawrence, independent Ohio coal strip mine operators, have disposed of some 500 acres of their holdings to Central Ohio Coal Co.

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AIR TOOL ACCESSORIES—MOIL POINTS, CLAY SPADES, ASPHALT CUTTERS, etc.

Kaiser Aluminum & Chemical Corp. has put into operation a recently completed fourth potline at its primary aluminum reduction plant near Ravenswood, W. Va. The fourth potline, with a capacity of 36,250 tons of aluminum a year, places the Ravenswood works into full operation with an estimated output of 145,000 tons of aluminum per year.

Eccles No. 6 mine, Eccles, W. Va., of Eastern Gas & Fuel Associates has been closed indefinitely due to market conditions.

Sharon Steel Corp. has purchased 3000 acres of coal properties near Kittanning, Pa., and plans to open a new mine and build a coal cleaning plant. The Mahoning mine area was acquired from Pittsburgh & Shawmut Railroad. The entire project is scheduled to be in operation within the next year.

The 14th Annual Off-the-Record Meeting of the Pittsburgh Section of the American Institute of Mining, Metallurgical and Petroleum Engineers and the Pittsburgh Section of the National Open Hearth Committee will be held November 6, 1959, at the Penn-Sheraton Hotel, Pittsburgh, Pa.

The North American Coal Corp. has acquired Warner Collieries Co. through an exchange of stock. Before the merger, North American, with mines in West Virginia, Pennsylvania and North Dakota, produced about 5,500,000 tons of coal per year. Warner's Jensie mine at East Springfield, Ohio, and the Hurricane mine at Mammoth, W. Va., are expected to add more than 1,000,000 tons of coal to this output.

General Portland Cement Company's board of directors has approved a $17,000,000 expansion and modernization program for its plants. This includes a project for the company's Tampa plant to increase its capacity by approximately 3,000,000 barrels of cement annually. General Portland recently acquired through a merger the plants of the Consolidated Cement Corp. at Paulding, Ohio, Fredonia, Kan., and Cement City, Mich.

Interlake Iron Corp. has announced plans to build a 3000-ton sintering plant at its Chicago merchant pig iron producing facilities. Designed to produce self-fluxing sinter, the plant will process iron ores, coke, flue dust and limestone into a premixed charge for Interlake's two Chicago blast furnaces.

NEWS and views



CF&I Plans Major Improvements

Colorado Fuel & Iron Corp. plans to issue and sell an additional $40,000,000 of first mortgage bonds.

About $21,000,000 of the proceeds from the issue will be spent on expansion, diversification and modernization of CF&I plants and properties. The rest of the proceeds will be used for simplification of the corporation's debt structure.

Of the $21,000,000 to be spent on plants, about $18,000,000 will be for expenditures at CF&I Western Division plants at Oakland, San Francisco and Pueblo, Colo.

The Pueblo plant alone will benefit from an expenditure of about $16,000,000. An $8,000,000 oxygen steel converter with a capacity of 50,000 ingot tons per month will be installed. The oxygen converter method of steel production has received wide acceptance as an efficient and low cost steel-making process.

Homestake Acquires Interest in Lance Claims

Lance Corp., a wholly-owned subsidiary of Sabre-Pinon Corp., recently announced that Homestake Mining Co. had purchased a 25 percent working interest in two sections of their McKinley County, N. M., uranium mining properties.

The transaction, which involved $1,350,000 gives both companies substantial new uranium reserves, and improve the Sabre companies' cash position.

The agreement gives Homestake a 25 percent interest in 1280 acres, which include the 600-tpd Section 12 mine. Sabre, through its subsidiary, continues to fully own and control mining leases on an additional 16,000 acres in the Ambrosia Lake region.

Sabre recently acquired all of the capital stock of Black Jack Corp., which owned the leases, and transferred them to Lance, which was formed as a wholly-owned operating facility to develop known ore bodies and continue exploration for future reserves. Lance will continue as sole operator of the joint venture.

Coal Key to Missouri Basin Future

An official of the U. S. Bureau of Mines told the Missouri Basin Interagency Committee in Douglas, Wyo., that low grade coal and lignite deposits hold the key for boosting the power potential of the Missouri Basin.

W. S. Landers, superintendent of the Denver coal research laboratory, said hydroelectric power will provide only about 17 percent of the estimated power needs of the ten-State Missouri Basin area by 1970.

Much of the additional power must come from coal. He pointed out that 41 percent of the Nation's coal reserves are in the Missouri River drainage.

The problem of finding a market for the by-products of lignite and other soft coal is one deterrent to use of coal for extensive power production at this time. However, he added, tests are being conducted in Texas to find a profitable market for coal tars and other by-products.

All of the Basin States were represented: Wyoming, Montana, Colorado, South and North Dakota, Minnesota, Missouri, Nebraska, Kansas and Iowa.

Susquehanna-Western to Buy Vitro's Ore

Susquehanna-Western, Inc. has contracted to purchase uranium ore from the Gas Hills properties of Vitro Minerals Corp. for processing at its new mill in Riverton, Wyo. Total purchases under the contract may exceed $15,000,000.

The agreement calls for the delivery of ore containing 480,000 pounds of uranium concentrate per year from Vitro's mines, and provides for shipments to the end of 1966.

The contract will mean a mining rate for Vitro of more than 100,000 tons of ore per year. Vitro is one of the largest ore shippers from the Wyoming area, where it is a pioneer in uranium mining. The Riverton mill, which has been in production since last November, has a capacity of 550 tons of ore per day and plans for an increase of capacity in the near future.



The Idaho Mining Association held its annual meeting at Sun Valley, Idaho, July 5-8. Officers shown left to right are: outgoing president, Wallace G. Woolf; L. J. Randall, the new president; J. C. Kiefer, vice president ; Harry W. Marsh, second vice president, and A. J. Teske, secretary.

The tough ones come to Card



How HOMESTAKE *solved two* HAULAGE PROBLEMS

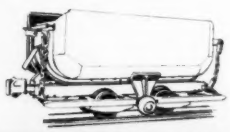
When Homestake Mining Company needed larger haulage capacity, Card engineers were called in. At Homestake, ore cars are automatically dumped while in motion, and haulage ways are limited in cross section. So, special Granby-type cars were chosen to replace the old gable-bottom cars.

Since 1939, 390 of these special Card cars have gone to Homestake on eight successive orders. Designed for maximum capacity, they have only a very minimum of side clearance. They are fabricated wholly of Cor-Ten plate and hold 60 cu. ft. Greatest design change over the years has been to a heavier liner plate to allow loading without the degree of ore fragmentation originally planned. Originally the cars were loaded through 14" grizzlies. Now they are loaded with the largest sizes that will clear the chutes.

Card has recently furnished 61 special Rocker Dump cars for development work at Homestake. These are well suited to handling waste and dumping in old stopes.

WHERE MINING CALLS

for efficient haulage, Card cars are the tested answer. Join Card's many customers. Their repeat orders are added proof of quality for you. Card engineers are at your service . . . no obligation.



C.S. Card Iron Works Co.

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ALSO . . .

American Gypsum Co. will build a $3,000,000 gypsum plant near Albuquerque, N. M., to manufacture wall board, lath and plaster board. Raw material will come from the 1180-acre White Mesa gypsum deposit near San Ysidro, about 30 miles northwest of Albuquerque. Construction is scheduled to begin in September and be completed by late 1960.

Blasting at stone quarries and other mining operations will be studied by U.S. Bureau of Mines scientists as part of intensified research on such vibrations and their effects on buildings, dams, and similar structures. The Bureau's study, which is being supported partly by associations of quarry operators and insurance companies, will seek basic knowledge needed by highway, construction and tunneling contractors as well as mine and quarry operators.

The USBM publication "Seismic Effects of Quarry Blasting," Bulletin 442, which was published in 1942 has been the authority on this subject for many years. Bureau officials believe, however, that recent advances in blasting techniques and explosive developments, along with improvements in seismic equipment, require that researchers undertake new studies.

Aluminum Company of America has announced it is stepping up production of primary aluminum metal by 40,000 tons a year by putting into operation two idle potlines —one at its Point Comfort, Texas, smelter, and the other at Vancouver, Wash.

A major expansion of its Red River Canyon operations in northern New Mexico is planned by Molybdenum Corporation of America if sufficient ore is found during the company's current exploration program. The company is now involved in an intensive core drilling program to prove reserves at its mining claims in the Red River area.

Mining and milling operations have been resumed at Consolidated Woodgreen Mines near Greenwood, B. C. The 1000-tpd capacity open-pit copper operation has been put into operation at a rate of about 500 tpd, but the company expects to increase production capacity within a few weeks. Concentrates will be shipped to the Tacoma smelter of American Smelting & Refining Co.

Production of elemental phosphorus has started at Central Farmers Fertilizer Company's new $10,000,000 Georgetown Canyon operation near Montpelier, Idaho. In its process, CFFC utilizes elemental phosphorus to make phosphoric acid. The acid is then used to treat high grade phosphate rock to produce high analysis, 52 percent P_2O_5 fertilizer. About half of the proposed run of raw material to the company's huge rotary kiln will have come through beneficiation processes. The other half will consist of a direct charge of higher grade ore.

The Idaho operation has attracted national attention because: it represents a major independent step of the farm cooperatives into phosphate fertilizer processing in competition with chemical companies; and it is the first time that anyone in the chemical fertilizer field, outside of the Tennessee Valley Authority, has attempted to produce high analysis superphosphate by the use of elemental phosphate.

A map of the moon will be available in the not-too-distant future. Dr. L. W. LeRoy, head of Colorado School of Mines' geology department, is charting the craters, lava flows and surface fracture patterns which show up in photographs of the lunar surface. He is now in his third year of intensive moon mapping and has covered roughly 4,000,000 square miles, or about half the surface that is visible to the earth. When the map is finished it will be used for navigational purposes by armed forces agencies and astronomers.

Construction of a $10,000,000 gypsum mill at either Lander, Riverton or Shoshoni, Wyo., is being considered by Vipont Mining Co. The mill would utilize the huge gypsum deposits on the Wind River Indian Reservation in the manufacture of wallboard and plaster.

Two Salt Lake scientists at the Research Center of Kennecott Copper Corp. have perfected the first commercial process for flotation of low grade columbium ores. In its patent application, KCC states that columbium minerals can be won from Canadian ores in economic grades as high as 19.3 percent columbium oxide by use of various members of quinoline family of organic chemicals. Following beneficiation, the columbium can be reduced to a metallic form by pyro-metallurgical techniques.



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BOOK REVIEW

Silhouettes of Charles S. Thomas

by Sewell Thomas

(The Caxton Printers, Ltd., 228 pp., 48 plates)

SEWELL THOMAS, of Denver, a mining engineer for more than 50 years, has written a biography of his father that covers much more ground than the title indicates. It is full of new material on the old "boom" mining camps of Leadville, Creede, and Goldfield.

Charles S. Thomas, born in Georgia, began the practice of law in 1871 in Denver, specializing in mining law. He lived at Leadville, Colo., from 1870 to 1884, and was intimately associated with hardrock mining virtually all his life. He participated vigorously in Colorado's rugged politics, and served with distinction as Governor and U. S. Senator. Although a lifelong Democrat, he voted against U. S. participation in the League of Nations and hated the New Deal, which was just getting into full swing when he died in 1934 at the age of 84.

It was only natural that his son followed a mining career, and Sewell's "silhouettes" of his father are liberally entwined with his own early experiences in the boom camps. The result is a graphic account, enhanced by many illustrations, of the mining towns and the noted and notorious people who lived in them during their heydays.

Much of the book is devoted to the two years which father and son spent at the height of mining activity shortly after the turn of the century in Goldfield, Nev., when its population reached 25,000.

Today's mining men will shudder while reading the account of working conditions in the Goldfield mines. Many were operated by lessees, who desired only to get out the maximum amount of ore before their leases expired. Capital expenditures were held to the absolute minimum. Hastily driven, scantily timbered shafts could get in dangerous condition before repairs were made. Stopes and galleries were little better, and roof falls were frequent; winzes and underhand stopes were generally unguarded. None of the processes of ore extraction was orderly in any sense.

By today's standards, ores were fabulously rich, and the miners considered it their prerogative to steal $100 or more of "high-grade" during each shift. This "easy come" money was freely scattered about the town, with most of it finding its way directly into the saloons, gambling houses, and the well-populated red-light district—and the book contains many entertaining stories based on the miner's "extra-curricular" activities.

The mine operators had their share of labor troubles, too. For a time the Industrial Workers of the World—the "Wobblies"—had complete control of Goldfield, and by use of boycott tactics even forced the closure of a newspaper which had printed some uncomplimentary facts about the union. Everything was unionized, including the boys employed to strap on roller skates at a skating rink, who were made union "miners" at $5 per shift. Conditions were intolerable until the 1907 financial panic gave employers the leverage needed to rout the Wobblies.

The biography closes with an account of Senator Thomas' activities in the Senate. It is particularly interesting to note that the Senator, obviously foreseeing the undesirable consequences of unrestrained union monopoly power, vigorously opposed exemption of unions from application of the Clayton Act when that antitrust law was enacted in 1913. During and immediately following World War I, he had considerable contact with President Wilson; excerpts from the Senator's speeches and letters reveal him as a statesman of high rank.

All in all, Sewell Thomas' book is a compilation of highly absorbing "silhouettes."

(Editor's note: This book will be on sale at the newsstand and drug store in the Brown Palace Hotel, Denver, during the AMC Convention, September 14-17.)

Three contracts have been granted by Consolidated Mining & Smelting Co. of Canada,, Ltd., in connection with its proposed $20,000,000 iron and steel smelter which will be constructed at Kimberley, B. C.

Foundation Company of Canada, Ltd., will erect buildings and install equipment. Lurgi Gesellschaft of Frankfurt, Germany, will supply sintering equipment and Elektrokemisk of Oslo, Norway, the first electric pig iron furnace.

The European companies performed the final test work for the electrothermic reduction process which will be used for the first time in North America. Work on the plant is now under way.

DIRECTOR OF

AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

ADELAIDE, SOUTH AUSTRALIA

The Research & Development Laboratories of the South Australian Department of Mines are to be reconstituted as the Australian Mineral Development Laboratories, and will be controlled by a Council representing the Mineral Industry, the Commonwealth Government and the Government of South Australia.

The Laboratories are installed in modern buildings in Adelaide and are well equipped for integrated mineral research, including analytical, mineralogical, chemical, metallurgical and chemical engineering investigations from bench to pilot scale. One of the prime functions of the Laboratories will be to perform mineral investigations for industry on a contract basis. Present employees number 130, including 75 professional officers.

Applications are invited for the position of Director of this establishment.

Duties—Responsible to the Council for the direction and administration of the Laboratories. The successful applicant will have considerable freedom in the selection of research programmes.

Qualifications—A University degree in Engineering or Science. Wide experience in mineral investigation and research. Experience in plant design and operation would be an additional qualification. The ability to direct and inspire research staff in the mineral development field is essential. Administrative experience is desirable.

Salary—Adequate salary will be fixed by the Council. It will be not less than £A4,250 per annum. Appropriate superannuation benefits will be provided.

Term—The period of appointment will be a matter for discussion between the successful applicant and the Council.

Accommodation—The Council will assist the successful applicant in obtaining suitable accommodation.

Removal Expenses—First-class fares and reasonable removal expenses to Adelaide will be paid for the successful applicant and his family.

Applications will be treated as confidential and should be addressed to —

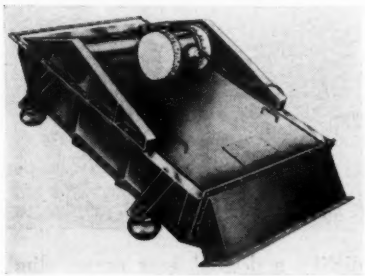
Australian Embassy,
1700 Massachusetts Avenue N.W.
Washington 6, D.C.

Closing date: 30th September, 1959

manufacturers forum

Rotary Vibrator Screen

A COMPLETELY SELF CONTAINED rotary vibrator powerful enough to efficiently handle a wide variety of applications and dust tight covers to prevent loss of materials and reduce dispersion are reported as primary features of an electromechanical screen just announced by Syntron Co., 703 Lexington Ave., Homer City, Pa. Called the RVS-146, this



unit is available with single or double deck screening areas and can be equipped with either a 900 or an 1800 rpm drive. It can also be supplied without dust-tight covers. The rotary vibrator is said to be totally enclosed, pressure-tight and water-proof, with sealed-in air-oil mist lubricant. The vibrator operates on 220 or 440-volt, 3-phase, 60-cycle alternating current.

Built in three sizes, the units are available for 10, 25 and 50 gpm output, with an available operating range of 20 percent above and below this figure, based on 500 Seconds Saybolt Universal lubricating oil at 100°F and 50 psi pump outlet pressure.

The new "Protecto-Lube" System reportedly is climatized for any conditions—tropical, temperate or frigid.

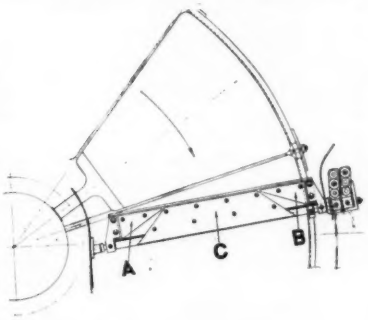
Air-Cooled Compressors

TWO SEMI-PORTABLE air-cooled compressors delivering from 311 to 635 cfm of air at 100 psi has been introduced by Atlas Copco Eastern of Paramus, N. J., and Atlas Copco Pacific of San Carlos, Calif. Designated the "AT" series, the two-stage machines are reportedly designed for use under extreme temperature ranges and in areas where water is dirty, corrosive or exceptionally expensive because of short supplies. Quick installation is claimed for them because of their extreme balance and smooth running characteristics, enabling them to be operated as semi-portable units on specially-designed skid frames.

The AT-1 compressor, which delivers 311 cfm at 600 rpm and 374 cfm at 730 rpm, stands 54 in. tall, is 51 in. wide and approximately 30 in. deep. The other model, AT-3, is 66 in. tall, 64 in. wide and about 40 in. deep. Its output is 533 cfm at 490 rpm and 635 cfm at a 585 rpm speed.

Disc Filter Scraper

BY FOLDING OR CONTOURING to the bellow of the filter bag, the contour scraper developed by Peterson Filters and Engineering Co. reportedly will increase a conventional disc filter's filtering capacity by thoroughly cleaning the filter bag.



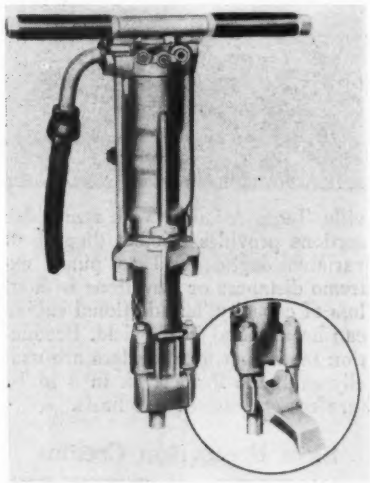
The contour scraper is a three-section scraper, as shown in the accompanying picture. The rubber blade is held in tension against the bag by plates (A, B and C), which hinge independently of each other. As the bag inflates, the center section, plate C, contours out while sections A and B are held in place and the rubber blade contours to the bellow of the bag. Adjustable spring tension on sections A and B is through an inner shaft to one lever arm and the center section C by adjustable spring tension through an outer shaft connected to the other lever arm. The contouring action remains free and, according to the manufacturer, will not freeze up from sludge because all parts are sealed and lubricated. Complete details can be obtained by writing to the company at P. O. Box 606, Salt Lake City 10, Utah.

Induction Voltage Regulators

SIZE AND WEIGHT REDUCTIONS for General Electric's Inductrol induction voltage regulators have been announced by the company's Voltage Regulator Product Section, Pittsfield, Mass. Single-phase ratings have been reduced in weight an average of 15 percent, with reductions on individual ratings ranging as high as 25 percent. Three-phase unit weights have been trimmed from 15 to 50 percent. Dimensions have also been reduced throughout the product line, which is available in three basic types —automatic, motor driven and hand operated.

Heavy Duty Sinker Drill

A COMPRESSIBLE RUBBER CUSHION which eliminates retainer springs is reported to be a key element in the Beavertail retainer of the CP-69 sinker drill. This design is



said to eliminate replacement of worn springs, and, in addition, contact has been substantially increased between drill steel and retainer collar, also minimizing retainer wear. The manufacturer also claims an all-new front head assembly in which vital chuck parts have been redesigned and safely enclosed within a protective, one-piece sleeve.

More details about this 55-lb drill can be obtained by writing to Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

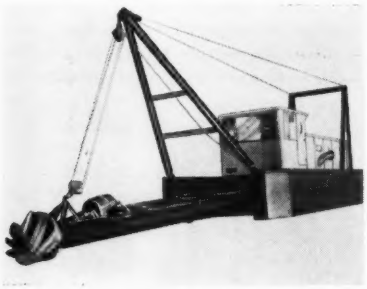
Bin Vibrators

A MORE POWERFUL UNIT has been added to the HI–VI line of bin vibrators by Eriez Manufacturing Co., Erie, Pa. Available in two types, the units are known as V3A-50P and V3A-50S. The 50P is of the "impact" type where vibratory output is in the form of steel on steel, and 50S is "semi-noiseless," having one of the impact elements semi-resilient to provide cushioned impact.

These units are for use on bin walls of ¼ in. maximum thickness with a capacity of 50 cu ft. Their more powerful impact is said to prevent clogging, sticking and bridging of stubborn materials in larger, heavier bins than those serviced by other V3A models.

Portable Dredge

INCREASED POWER AND LESS MAINTENANCE is claimed for the Ammco "Hydra-Drive" portable dredge by American Marine and Machinery Co., P. O. Box 1150, Nash-



ville, Tenn. A ladder with removable sections provides efficient digging at variable depths, and to pump extreme distances or elevations without loss of capacity, an additional engine can be installed in the field. Production model portable dredges are usually available from stock in 8 to 18 in. sizes on lease or sale basis.

Skin Protection Creams

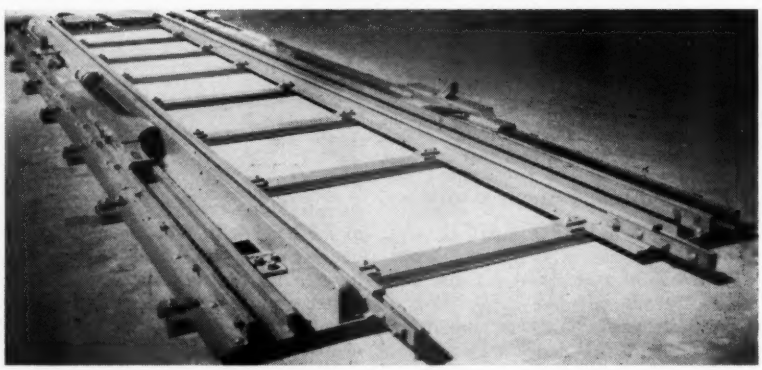
AVAILABLE IN THREE SPECIAL PURPOSE FORMULAS, the creams are said to provide protection against virtually any skin irritant commonly encountered in industry. All three cream formulas contain hexachlorophene for bacteriological and anti-fungus effects, as well as an exclusive deodorant. They can be removed in mild soap and water. An emollient feature prevents drying, cracking or chipping. Bulletin 0403-4 on M-S-A FEND creams is available from Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh, Pa.



Transmission Control

FINGER TIP SHIFTING of Caterpillar DW20 and DW21 tractors is provided by SynchroTouch Transmission Control introduced recently as optional equipment by Caterpillar Tractor Co., Peoria, Ill. A prime advantage claimed for this development is its feature of permitting operators to quickly shift up or down, by dialing a desired gear range, eliminating the usual gear-shifting operations required by standard direct drive transmission and resulting in the reduction of shifting time from a multi-second to a fractional-second interval. The SynchroTouch is controlled by a gear selector mounted on top of the control box and replaces the gear shift lever.

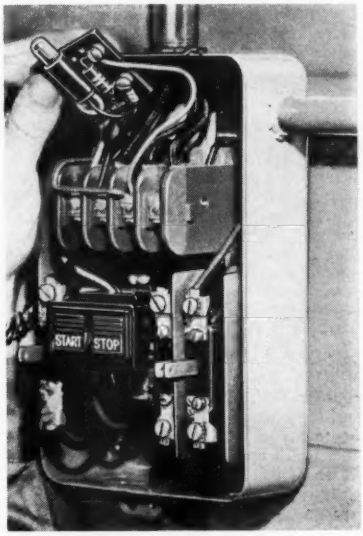
Car Spotter



A SPLIT-TRACK MODEL of Porta-Feeder for precision car spotting has been announced by Nolan Co., Bowerston, Ohio. The unit mounts the operating mechanism on both sides of the track, rather than between the tracks as in the standard model. Advantages claimed are easy and immediate accessibility and no interference by any part of the feeder with mine car axles, coupler or brake rigging. The model also collects less coal.

Motor Starter

UNITIZED CONSTRUCTION is the key design feature of a line of size 0 to size 4 starters recently released by Allis-Chalmers Mfg. Co.,



Milwaukee, Wis. A full range of standard, special-design and accessory control devices are available in these sizes for application from 110 to 600 volts for fractional to 200 hp motors. The benefit to users through unitized construction is said to be block-building modifications for economic versatility.

Swivel Connector

CAPABLE OF DELIVERING HYDRAULIC FLUID at any angle under adequate pressure the 90° Swivel Connector eliminates hydraulic hose failure under severe flexing, according to Eastman Mfg. Co., Manitowoc, Wis. It "follows" the travel of a crane, for example, thereby relieving the extreme flexing strain which was formerly absorbed entirely by the hose. Other applications are to be found on loaders, earth moving equipment, and hydraulic presses.

Various combinations of stems can be interchanged with any body style. Ends which are presently available include male pipe, hydraulic male, "O" Ring male, plus solid and swivel female, in sizes ranging from ½ in. through 1½ in. The unit is machined out of bar steel and plated for corrosion protection.

ANNOUNCEMENTS

Herman H. Pancake has been named administrative vice president



of **Irwin-Sensenich Corp.,** manufacturers of mining and industrial equipment. Formerly affiliated with the American Car & Foundry Division of **ACF, Inc.,** as manager of mining and industrial sales, Pancake is the holder of numerous U. S. patents on drop-bottom mine cars.

United States Steel Corp. has announced the appointment of **Marcus M. Chapman** as an administrative vice president commercial. He will be succeeded as vice president sales by **Howard J. Mullin.**

Joy Mfg. Co. has made three new appointments in its Coal Machinery Division. **R. A. Lehner** has been named vice president and assistant general manager of the divi-



R. Lehner



J. Courtwright



R. Hair

sion. At the same time **J. P. Courtwright** was named vice president—sales, and **R. T. Hair** appointed vice president—technical services.

Carter P. Thatcher has been appointed Vice President, Mining Operations for **Yuba Consolidated Industries, Inc.** It was announced that Thatcher will concentrate on expansion of Yuba's mining activities, including current explorations. He is a graduate of Yale Law School, and has been in the Yuba organization since 1957 with headquarters in San Francisco.

Goodman Manufacturing Co. of Chicago has opened a new warehouse at West Frankfort, Ill., for the convenience of mines in southern Illinois, Indiana and western Kentucky. This completely stocked outlet of renewal parts for Goodman machinery is under the supervision of **Roy Soper,** supply manager for the area, who is assisted by **Ward Carlson,** factory trained for the post of warehouse manager.

William E. Umstattd will retire as president of **Timken Roller Bearing Co.,** Canton, Ohio on Sept. 1. He will become chairman of the executive committee.

Martin B. Jaeger has been appointed to the newly created post of advertising manager for **Koehring Co.** He will be responsible for directing the product advertising and publicity programs for all Koehring divisions and subsidiaries.



Jaeger was formerly manager of advertising and publicity for **Bucyrus-Erie Co.** as well as publisher of *Excavating Engineer* and *The Driller.*

CATALOGS & BULLETINS

WATER TREATMENT EQUIPMENT. *Process Engineers, Inc., Division of The Eimco Corp., 420 Peninsular Ave., San Mateo, Calif.* Bulletin SM-1013 features the Reactor-Clarifier, an Eimco-Process development combining coagulation and flocculation, sedimentation and sludge removal in a single unit. Both standard rate and high rate types are shown. Also illustrated and described are Eimco-Process flash mixers and contactors, clarifiers and flocculation mechanisms, an automatic enclosed rapid sand gravity filter system, an eductor type proportioning liquid chemical feeder and other water treatment and conditioning equipment.

CUTTING COSTS IN COAL MINING. *Advertising Division of Caterpillar Tractor Co., Peoria, Ill.* How to improve the efficiency of coal mine operations is the subject of this two-color eight-page book which describes the use at coal mines of crawler tractors with rippers and dozers, wheel-tractor-scraper units, Traxcavators, wagons and motor graders. The booklet's title and form number D925 should be included with requests.

(Continued on next page)

(Continued from previous page)

SHUTTLE CARS. *National Mine Service Co., Indiana, Pa.* National Mine's TorKar shuttle car is detailed in a four-page brochure and series of specification pages. The bulletin presents full technical information on all main TorKar components, while the specification pages provide data on each of a series of types.

ARC WELDING. *Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa.* The data card, TDC-155, summarizes the various recommendations for arc welding and provides information on suggested pre-heat and post-heat treatments. It also indicates proper type of electrodes to be used. Steels discussed are carbon steels, chromium-molybdenum alloy steels and stainless steels.

REPLACEMENT PARTS FOR TRACTORS. *Columbia Steel Casting Co., Inc., 933 N.W. Johnson, Portland 9, Ore.* Replacement parts for most makes of tractors are featured in a four page brochure illustrating the company's range of production capabilities and typical tractors replacement components they manufacture. Request Columbia Bulletin No. 1062.

RUBBER TIRED CUTTING MACHINES. *Goodman Manufacturing Co., Halsted St. and 48th place, Chicago 9, Ill.* Catalog G-138 describes the company's 2400 series of rubber tired cutting machines.

SCREENS. *Pioneer Engineering, Division of Poor & Co., 3200 Como Ave., Minneapolis, Minn.* Several improvements made recently to the Mesabi screen line are described in the 16 page booklet, Form 651A. Special attention is paid to the addition of secondary spring type of screen suspension which, it is said, eliminates transfer of vibration to supporting structure, increases screen efficiency and reduces strain on screen assemblies. Illustrations of this new type screen suspension on both portable plant-mounted screens and stationary installation screens are shown. A cut-a-way view of the Mesabi screen shaft assembly is also included, showing in detail, location of shaft, bearings, pulleys, flywheels and other component parts.

DIESEL ENGINE LOG BOOK. *Engine Div., Caterpillar Tractor Co., Peoria, Ill.* Booklet No. 20167, called "Engine Log Book," covers 13 months of operation and contains space for daily entries on fuel and lube oil consumption, parts, service, repairs, etc. Monthly entries may be transferred to a 12 month summary sheet and a post card is enclosed with which the operator can order a new book when the old one is used.

FACILITIES BOOKLET. *Advertising Department, Lake Shore, Inc., Iron Mountain, Mich.* Lake Shore's complete manufacturing facilities are listed, including machinery, plants, supply and service centers, sales offices and products. The 12-page booklet inventories the company's boring mills, planers, lathes, milling machines, drill presses, grinders, miscellaneous machine tools, shears, brakes, presses, cutters and saws, welding equipment for soft steels, stainless steel and aluminum, materials handling equipment and other large equipment.

OPEN-END V-BELT BULLETIN. *Flexible Steel Lacing Co., 4675 Lexington Ave., Chicago, Ill.* Entitled "Custom Made V-Belts with Alligator V-Belt Fasteners," Bulletin V-227 offers information on the use of these fasteners with open-end V-belting and includes a variety of illustrations and charts on the subject.

CRAWLER TRACTOR. *Sales Promotion Dept., Euclid Div., General Motors Corp., Cleveland 17, Ohio.* Form No. 606 shows photographs, drawings, and cutaway and sectional views which explain twin-power application. Torqmatic drive and other design features of Model TC-12 Twin Power Crawler Tractor. Condensed specifications and a performance chart are also given.

FULLY SUBMERSIBLE ELECTRIC PUMPS. *Stenberg Manufacturing Corp., Hoosick Falls, N. Y.* A heavy duty, submersible electric pump, FLYGT B-80L has a capacity of 300 gpm against a head of 25 ft or 70 gpm at 150 ft and weighs only 175 lb. It can run for long periods without supervision. Other features of the FLYGT pump are said to include its ability to handle highly abrasive material and to run dry without damage.

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M-722

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Newly issued U.S. Bureau of Mines Approval 6D-31, April 16, 1959.

MSA SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY • 201 North Braddock Avenue, Pittsburgh 8, Pennsylvania

MINE SAFETY APPLIANCES CO. OF CANADA, LIMITED • Toronto, Calgary, Edmonton, Montreal, Sydney, Vancouver, Winnipeg

Look how small the headpiece is. Weighs only a few ounces. Feels even lighter on the head. You get a clear, sharp spot every time.

Increase in working light appeals to me. This new Edison Model S gives 15% more than we ever had before. And they didn't cut their bulb service life rating to do it. The double filament bulb means we'll always have working light to finish the shift. Each filament of the Edison Model S krypton-gas-filled bulb has a 400-hour designed life.

Just watch the improvement in our safety and tonnage reports. More light. Less weight. Longer life. Even the battery's better. It has a new active material that boosts service life. They went all-out to meet the miner's needs with this one.



